No. 83-333

IN THE

SUPREME COURT OF THE UNITED STATES

October Term, 1983

C.P. CHEMICAL COMPANY, INC., Appellant,

v.

COMMISSIONER OF PUBLIC HEALTH, Appellee.

ON APPEAL FROM THE MASSACHUSETTS SUPREME JUDICIAL COURT

APPELLANT'S PARTIAL APPENDIX

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COMMONWEALTH OF MASSACHUSETTS

SUFFOLK, ss.

SUPERIOR COURT
Nos. 38,508-38,473
41840,49725, 46647

BORDEN, ET ALS

VS.

COMMISSIONER OF PUBLIC HEALTH

FINDINGS, RULINGS & ORDER

STATEMENT OF THE CASE

These cases were previously consolidated and were the subject of a protracted trial. Each case involves the common issue, i.e. the validity of certain regulations promulgated by the Commissioner of Public Health. The first set of regulations is entitled "Regulations Concerning Hazardous Substances" and was issued on November 14, 1979. The second set is entitled "Regulations Concerning Repurchase of Banned Hazardous Substances" and that set of regulations was issued on November 20, 1980.

Briefly stated, the Commissioner bans all residential future sales of urea formaldehyde foamed- in- place insulation (hereinafter UFFI); and creates an administrative procedure whereby homeowners who have suffered any of certain symptoms may secure an order from the Department of Public Health requiring the installer, distributor, or manufacturer to remove it, refund the purchase price and restore the home. The cost of removal and restoration is very significant.

In Suffolk numbers 38508 and 38473, Borden and C.P. Chemical, two manufacturers, many contentions are made. First, regulation invalidity because of failure to afford an adjudicatory hearing. This contention is grounded in statutory construction as well as constitutional principles. Second, if the plaintiffs were not entitled to a prior adjudicatory hearing, then, as a matter of right, they are entitled to a judicial review-not limited to any agency record.

In this argument they are joined by the Formaldehyde Institute in Suffolk 41840.

The focus of Berkshire Gas (49725) as well as the Anderson case (46647) is solely upon the repurchase regulations and upon the significant liabilities that they will sustain if those regulations are upheld. However, these plaintiffs share with the manufacturers, at least as to repurchase, the contention that an adjudicatory hearing prior to the regulation is required and they also share the contention of constitutional due process deprivation. All and each of the plaintiffs have advanced numerous other contentions.

Discussion

Certain initial observations seem appropriate. Because of the factual complexity, the findings of fact have been divided under particular headings to permit an easier understanding by the parties and examination by an appellate reviewer. With respect to the rulings of law I have attempted to avoid any extended discussion but this was not always possible.

FINDINGS OF FACT

I

PARTIES

1. Plaintiff, Formaldehyde Institute, is a voluntary association comprised of some 62 companies who manufacture or use formaldehyde or formaldehyde-based materials. The Formaldehyde Institute operates through several committees, including a Medical Committee and a Technical Committee. The principal offices of the Formaldehyde Institute are located in Scarsdale, New York.

2. Plaintiff Dodge Chemical Company ("Dodge Chemical"), is a corporation duly organized under the laws of the Commonwealth of Massachusetts with its principal place of business located in Cambridge, Middlesex County, Massachusetts. Dodge Chemical is engaged in the manufacturing, sale and distribution of embalming chemicals. Dodge Chemical is a user of formaldehyde and is a member of the Formaldehyde Institute.

3. Plaintiff, Hardwood Plywood Manufacturers Association ("HPMA"), is a corporation duly organized under the laws of the State of Illinois with principal offices in Reston, Virginia. HPMA is a national trade association composed of some 170 companies manufacturing building supplies such as hardwood plywood and suppliers to that industry. The products manufactured, such as plywood, contain formaldehyde and formaldehyde-based resins. Members of HPMA do business in Massachusetts. HPMA is a member of the Formaldehyde Institute.

4. Plaintiff, E.I. du Pont, de Nemours and Company ("DU PONT"), is a corporation duly organized under the laws of the State of Delaware with principal offices in Wilmington, Delaware. DU PONT manufactures and sells formaldehyde

and formaldehyde-based products such as paint and plastics. DU PONT does business in the Commonwealth of Massachusetts and has offices in the Commonwealth. DU PONT is a member of the Formaldehyde Institute.

5. Plaintiff, Celanese Chemical Company, Inc. ("Celanese"), is a corporation duly organized under the laws of the State of Texas with principal offices in Dallas, Texas. Celanese manufactures formaldehyde. Celanese does business in the Commonwealth and has offices in the Commonwealth. Celanese is a member of the Formaldehyde Institute.

6. Champion International Corporation ("Champion") is a corporation duly organized under the laws of the State of New York with principal offices in Stamford, Connecticut. Champion manufactures and sells building materials and paper products, many of which contain formaldehyde and formaldehyde-based resins. Champion does business in the Commonwealth and has offices here. Champion is a member of the Formaldehyde Institute.

7. The Manufactured Housing Institute, Inc. ("MHI") is a non-profit corporation duly organized under the laws of the State of Illinois with principal offices in Arlington, Virginia. MHI is a national trade association of manufacturers of mobile homes and suppliers to that industry. Formaldehyde and urea formaldehyde-based resins are used to manufacture products, such as particleboard, used in the manufacture of mobile homes (as well as in site-built housing). Members of MHI do business in Massachusetts. MHI is a member of the Formaldehyde Institute.

8. Plaintiff, Georgia-Pacific Corporation ("Georgia-Pacific"), is a corporation duly organized under the laws of the State of Georgia with principal offices in Portland, Oregon. Georgia-Pacific manufactures building materials and paper products, many of which contain formaldehyde-based resins.

Georgia-Pacific is a member of the Formaldehyde Institute.

9. Plaintiff, Weyerhaeuser Company ("Weyerhaeuser"), is a corporation duly organized under the laws of the State of Washington with principal offices in Tacoma, Washington. Weyerhaeuser manufactures building materials and paper products including building materials containing urea formaldehyde resins. Weyerhaeuser does business in Massachusetts and has offices in Massachusetts. Weyerhaeuser is a member of the Formaldehyde Institute.

10. Plaintiff, Borden, Inc. ("Borden"), is a corporation duly organized under the laws of the State of New Jersey with principal offices in Columbus, Ohio. Borden manufactures formaldehyde. In addition, Borden manufactured the components for a urea formaldehyde foamed-in-place insulation ("UFFI") sold in Massachusetts under the registered trademark, Insulspray. Borden ceased manufacturing UFFI in the United States on December 31, 1978.

11. C. P. Chemical Company ("C.P. Checmical") is a family-owned and controlled small business enterprise, located in White Plains, New York, which manufactures, among other items, the resin and foaming agent for a series of foam insulation products marketed under the name of Tripolymer.

12. Plaintiff Anderson Foam Distributors is a Massachusetts Corporation having an usual place of business in Abington, and has been in the business of installing insulation in both residential and commercial structures.

13. Plaintiff Berkshire Gas Company is a Massachusetts Corporation, a public utility serving the western portion of the state and which purchased UFFI and contracted with many of its customers, and others, to install the insulation in their homes.

14. The sole defendant Alfred L. Frechette is the duly appointed Commissioner of the Department of Public Health for the Commonwealth of Massachusetts.

II

THE NATURE AND PRESENCE OF FORMALDEHYDE

Formaldehyde, a colorless, gaseous compound of carbon, hydrogen and oxygen (HCHO), is omni-present. It is found in the atmosphere, where it is continuously introduced through a variety of natural processes. When sunlight strikes plant life, there is a photochemical generation, and formaldehydes and other aldehydes are directly released into the air. These are rapidly reacting molecular products. Because of a high water solubility, formaldehyde is transferred in rain, surface water and oceans. This reactivity is, however, indicative of a short life span in an irradiated lower atmosphere. It is biodegradable.

Man also injects formaldehyde directly into the atmosphere. Approximately six pounds of formaldehyde is produced during the combustion of 1,000 pounds of automobile gasoline, and the exhausts of automobiles measured during operation have registered discharge of twenty-nine to forty-three parts formaldehyde per million parts of air. Also, formaldehyde is emitted from many manufacturing, industrial and power plants. Indeed, it is a by-product of any machine or other burning in which hydrocarbon fuels or substances are incompletely burned. Therefore, even the home gas stove or the use of cooking oils will produce free formaldehyde. In sum, aldehydes are introduced into the ambient air as a result of photoxidation of both naturally occurring and anthropogenic hydrocarbons.

Formaldehyde is present in certain fruits and vegetables; for example, apples and potatoes.

Additionally, formaldehyde is found in all mammals, and specifically within the human body. It is one of the substances produced by the human system during metabolism, although it does not accumulate, but is rapidly metabolized. Persons who smoke introduce significant levels of formaldehyde, up to forty parts per million, in their immediate environment.

Therefore, in any environment, there are ambient concentration of formaldehydes and other aldehydes (formaldehyde is the dominant aldehyde usually consisting of between a third and three-fourths of the aggregate present) and these concentrations depend on both their rates of formation and the subsequent removal reactions that occur. Obviously, urban atmosphere concentrations are generally appreciably greater than rural areas. These concentrations are usually measured on a part per million parts of ambient air basis. In most in-door environments, twenty-four hour average formaldehyde concentrations of 0.05 to 0.2 per million parts are not uncommon today. With respect to the atmosphere, formaldehyde has been measured at levels ranging from .005 to .008 in rural ambient air, to levels ranging up to .2 parts per million in urban outdoor air.

III

THE NATURE OF AND PRESENT COMMERCIAL SIGNIFICANCE OF UREA FORMALDEHYDE RESIN

Commercially, aldehydes are produced at a rate of several billion pounds a year in the United States. Formaldehyde is the most commercially significant and is prepared in a thirty-seven to fifty percent aqueous solution at a rate of over eight (8) billion pounds a year. About half of that production is used in the preparation of urea formaldehyde and phenol formaldehyde resins. These resins were developed in Europe where the condensation reaction between urea and formaldehyde was reported before the year 1900.

These resins are used in the production of plywood, particle-board, foam insulation, and a wide variety of molded or extruded plastic items. Another twenty-five percent of the formaldehyde produced is used in other resins or polymers, and is used in disinfectants, textile treatment agents, and in leather processing and dye manufacture. A partial list of presently manufactured products in common use in which a formaldehyde polymer is utilized includes fertilizers, fungicides, clothing, cleansers, textiles, waterproofing, fur, wood and leather preservers, lacquers, varnishes, papers, film, glues and adhesives, dyes, drugs, ladies' cosmetics and deodorants.

Indeed, it is the formation of resinous products on reaction with other chemicals which is the most useful characteristic of formaldehyde. It is the reason for its immense importance in the synthetic resin industry.

Under suitable conditions, the molecules of many different compounds may be linked together by methylene groups when subjected to the action of formaldehyde. Phenol and urea formaldehyde resins are polymethylene compounds of this type. Urea formaldehyde resin is a mixture of products from the condensation between the two. The resultant structure beyond the first stages of condensation is complex. Probably two distinct processes are involved in this polymerization. The structure of the resin beyond the first stages is not well known. Formaldehyde is present in a variety of forms. Three types of combined formaldehyde are methylol end groups ($NHCH_2-N\overline{CH_2OH}$), dimethylene ether bridges ($NH-\overline{CH_2OCH_2}NH$) and methylene bridges ($NH\overline{CH_2}NH$). Methylol end groups are the most reactive of the combined forms of formaldehyde. Dimethylene ether bridges are less reactive than methylol end groups. Methylene bridge cleavages are the most stable and are split only when heated with a very strong mineral acid.

IV

THE NATURE OF UFFI AND OTHER FINDINGS CONCERNING THIS INSULATION

The original use of polymerized urea and formaldehyde to generate a plastic foam was developed in Germany in 1933. These foams were introduced as insulation materials in 1958, and have been used extensively in northern Europe since the early 1960s. It was only after the Arab oil embargo in 1974 that urea formaldehyde foam insulation was energetically marketed in the northeast section of the United States, and there are no reliable compilations which set forth the number of installations either within this Commonwealth or within these United States. However, it can factually be safely stated that; 1.) UFFI was marketed with increasing success in 1975, 1976 and 1977, and the sales nationally increased in each of those years, and in 1978, there was a significant falling off; and 2.) that at least approximately four hundred thousand residences within the United States have been insulated with UFFI.

In the production of urea formaldehyde foam insulation (UFFI) a urea formaldehyde resin is used. This is the same type of resin used as adhesives in such products as plywood and particleboards and many paper products. The foam has three components, the polymerized urea formaldehyde resin, a foaming

agent which is usually called a surfactant, and air. The product is generated on the job site, using portable equipment. It requires an air compressor and a mixing or foaming gun. The foaming agent, which usually contains an acid catalyst, is pumped into the gun, where air mixes with it to form small bubbles. These bubbles then are coated with the resin, which is introduced into the gun by a separate line. Thereafter, the resin coated bubbles are forced out of the gun or tube, and the resin, having mixed with the foaming agent, begins to polymerize or cure. Polymerization rates are dependent upon temperature of the ingredients, and temperature and humidity in the atmosphere.

The quality of the resultant product is dependent on the quality of the ingredients, the correctness of the ratio and mixing, the age or shelf age of the resin and its viscosity, as well as the temperature at which the foaming occurs. The product which enters the wall cavity has initially the appearance of whipped cream or shaving cream, and as it cures, becomes stiff and self-supporting.

The advantage of UFFI is easy handling, transport, and ease of installation. It is particularly suitable insulation for older homes, since the foam can enter through a small opening and be delivered to the entire area of any given cavity. It is relatively inexpensive, with the average cost for the average

seven-room house being $1,200 to $1,400, and has excellent insulating qualities. It is relatively nonflammable. The National Aeronautic and Space Administration (NASA) selected Tripolymer, a foamed insulation, in a prototype solar house and found it to be nonflammable, nontoxic, rodent resistant and odor free with a 30 to 45 percent less heat loss than fiberglass insulation. A fuel cost saving of 47 percent was demonstrated after another Tripolymer insulation by a Housing and Urban Development (HUD) study.

There are, however, certain disadvantages. The amount of formaldehyde added to the mixture is critical. First, the more formaldehyde the faster polymerization, which in turn increases stability of the product and lowers its manufacturing costs. Adequate formaldehyde is vital to provide sufficient cross-linking so as to cause satisfactory stabilizing properties in the final product. However, any excess in formaldehyde results in unreacted formaldehyde in the final product. This free formaldehyde tends to slowly diffuse from the insulation foam and may result in increasing the indoor air formaldehyde concentration. Most urea formaldehyde resins used in the manufacture of UFFI's contain only less than .5 percent formaldehyde by weight, and contains less than .01 percent formaldehyde by volume.

In addition to unreacted formaldehyde, urea formaldehyde foam is subject to hydrolysis. Essentially, the hydrolysis reaction is a reversal process. When the insulation of resins are exposed to water or a humid atmosphere, the UFFI may absorb moisture, and consequently, a process of degradation which releases formaldehyde follows. For example a methylol end group ($NHCH_2$-N-CH_2H) subjected to moisture ($+H_2O$) by hydrolysis resulting ($=NHCH_2+CH_2O$) a release of formaldehyde. Since urea formaldehyde resins are utilized in chipboards, particleboard and plywood, those products also are subject to hydrolysis, and may also emit formaldehyde. Indeed, the same is true of many formaldehyde polymers. However, focusing on UFFI, it is obvious that the installation must be proper in all respects of mix and formulation. If excessive foaming agent is used, or if there is excessive acid catalyst in the surfactant, the result is as bad as use of excessive resin. The process by which excessive acidity contributes to the potential for formaldehyde emission is by breaking the bonds attaching the single end formaldehyde molecule to the chemical chain of the compound. Another common factor which contributes to the potential for emission of formaldehyde from UFFI is the addition of excessive acid foaming agent hardener by the installer. At least a substantial portion of the emission problem can be attributed to poor installation techniques or improper use of materials.

Foaming with cold chemicals, or foaming during a period of high humidity also are factors which may constitute contributing causes to formaldehyde release.

Of course, any free formaldehyde that is present in UFFI is not necessarily emitted from UFFI into the interior of the house because it may remain in the interior of the foam, it may be "trapped" within the air bubbles or captured by various ingredients with the potential for minimizing formaldehyde emissions which are added to the UFFI for that reason and, because, lastly, if emitted from the foam, it may be emitted into the outdoor ambient air.

V

FINDINGS CONCERNING TWO PARTICULAR UFFI PRODUCTS, INSULSPRAY AND TRIPOLYMER

Two particular foam insulations were the subject of evidentiary focus in the present proceedings. This was not the case at the time of the Administrative Hearings which preceded the ban.

"Insulspray", so-called, is the trade name for Borden's patented UFFI. This product was developed in a joint venture between a Borden affiliate and the Canadian Government. Insulspray added a certain number of ingredients, including resorcinol, dicyandiarmide and ethylene glycol to reduce the potential for formaldehyde emission or "off-gasing". Resorcinol, in particular, acts as a scavenger to react with free or freed formaldehyde. Insulspray was distributed in Massachusetts by one independent distributor to approximately twenty to thirty installers. Some 1,260 Massachusetts homes have been insulated with Insulspray. That Insulspray was withdrawn from the American Market in 1978 or 1979.

"Tripolymer", so-called, is the trade name for C. P. Chemical's patented phenol urea foam. The resin and foaming agent are manufactured in White Plains, New York. C. P. Chemical contends that its product is not a UFFI. The combining of phenol

with methylol urea significantly increases the stability of Tripolymer because many more methylene bonds are formed and significantly less hydroxyl methylol bonds are produced. Therefore, the potential for formaldehyde emission by hydrolysis is much lessened. This introduction of phenol, however, does not so drastically alter the resultant structure, physical properties and characteristics so as to take it outside of the UFFI family in the generic sense. This is so because the formaldehyde release mechanisms are the same, even though it must be conceded that Tripolymer is a more stable compound than certain other UFFI products. The free formaldehyde content in Tripolymer 102 is 0.08 percent and in the 105 resin less than .0001, the lowest sensitivity range of the accepted HUD test measuring procedure. Tripolymer was distributed within this Commonwealth by shipping to C. P. of New England in New Hampshire, which in turn distributed to the five installers that it had certified in Massachusetts. Some 863 homes in Massachusetts were Tripolymer insulated. There was one complaint made.

Both Borden and C. P. Chemical have certain quality controls which are utilized in connection with their respective products. Both have quality control procedures governing the manufacture of the resin and foaming agent. C. P. Chemical subscribes to an independent inspection program by which Factory Mutual Research

makes random monitorings of both resin and foaming agent, checking viscosity, acidity and solubility, while Borden manufacturing processe includes tests by two independent laboratories. Insulspray installers are selected and trained by its-distributors. This training encompasses a five-day period involving both classroom and hands on training, as well as on-the-job experience. All Borden installers are instructed to conduct periodic density tests of both the flow rate of resin and foaming agent and testing for quality of foam. Borden representatives conduct sporatic job site spot checks. C. P. Chemical trains each installer itself and requires its certification as a prerequisite to selling its product to any installer. Its training program is four to five days at its plant (or over four or five weeks at various job sites). Each prospective installer must pass a written examination and foaming test prior to certification. All installers are directed to undertake wet density quality control checks every twenty to thirty minutes during actual installation of the foam.

Both Borden and C. P. Chemical have patented foam mixing "guns" so-called. It is in these devises that the resin, foaming agent, and air are combined and the foam expelled under pressure. Special nozzles and certain pressure gauges guarantee consistency of mix and flow. Additionally, C. P. Chemical has in line

heaters to maintain correct foaming temperatures for its ingredients. C. P., which leases its gun and pumping system, provides a scheduled maintenance for these systems as well.

Prior to the ban in Massachusetts, Tripolymer 102 had been installed in 50,000 homes over these United States with a complaint rate of twenty-six hundredths of one percent. Tripolymer 105, which is the product C. P. Chemical currently markets, has been installed in 5,330 homes with no complaints to date.

The administrative hearings did not consider any specific product, but rather treated all the foam products generically; alluding generally to the "Chemical Composition of UFFI" on pages 5 and 6 of the Commissioner's finding, and declaring a banned hazardous substance "Urea-formaldehyde foamed in place insulation" without ever attempting to define it. See 105 CMR 650.020.

From the evidence produced at trial, I find, insofar as it is a question of fact, that Tripolymer insulation, if subjected to proper regulations has the capacity to be installed so as to eliminate or cure any vapor problem that has been experienced in Massachusetts. I further find, by a fair preponderance of that evidence that regulations regarding quality product control, licensure, and standards for installation may be reasonably fashioned which would permit a urea formaldehyde of the Insulspray type to be safely used.

VI

MEASUREMENT OF FORMALDEHYDE AND WITHIN UFFI HOMES

The measurement of formaldehyde levels within any particular environment is best established by what is called the chromotropic acid test which records the parts of formaldehyde per million parts of air sample. The Department of Public Health in this particular matter undertook 198 chromotropic acid tests of the formaldehyde level in houses in which urea formaldehyde based foam (hereinafter called UFFI) had been installed. The tests were not randomly representative, but were selected from those consumers who had previously made complaints to some state agency. There were no tests of formaldehyde level made by the Department in any non UFFI homes. Additionally, there were no tests made by the Department to determine any representative or random outdoor ambient levels. Therefore, no comparison between UFFI and non UFFI houses has ever been had, nor is such a comparison presently possible from the Department's data. Lastly, chromotropic acid tests measure the concentration of formaldehyde and do not in any way attempt to distinguish or identify source. In 21 percent of the 198 UFFI homes the Department tested, no level of formaldehyde was found. Additionally, in 156 out of 198 UFFI homes, or seventy-eight percent of the entire test sample, the level of formaldehyde was found to be .09 or less per

million parts of ambient air. Lastly, the Department's testing revealed all 198 houses to have a level less than .5 parts per million parts of air.

Although the Department never undertook such a study, there has been research without the Commonwealth. A University of Iowa Group measured 31 randomly chosen non UFFI homes with the chromotropic acid test and found an average level of .06 formaldehyde per million parts as against an average level of .05 formaldehyde per million parts for 116 randomly chosen UFFI houses. At the present state of the technical knowledge and expertise, there has been no showing that the ambient level of formaldehyde concentration in houses in which UFFI has been properly installed is significantly more appreciable or different than the level of formaldehyde in similar houses without UFFI.

VII

FINDINGS REGARDING HEALTH EFFECTS OF EXPOSURE TO FORMALDEHYDE AND PRESENT SCIENTIFIC INABILITY TO DRAW TOXICITY STANDARDS WITH REASONABLE SCIENTIFIC CERTITUDE

Relatively low airborne concentrations of formaldehyde will produce adverse health effects upon persons so exposed. As exposure levels increase from zero man's tolerance decreases and at some point of concentration level, the border between tolerance and toxicity is crossed. There is a wide disparity of opinion as to the level of exposure below which adverse health effects will not be experienced. In all 198 homes (or 100%) with UFFI which were tested for ambient formaldehyde by the Massachusetts Department of Public Health, the Department found a level of formaldehyde which was less than 0.5 ppm which is the level that the former Deputy Commissioner had publicly stated is "usually not problem causing" and "which is the level that adequately protects the general population." Within the scientific community, opinion as to the acceptable level of human exposure to formaldehyde varies from .03 to .5 parts per million parts of air. Moreover, it has been the observation of that group that most persons will not experience any conscious irritation from exposures at levels below 0.5 ppm concentrations. Of course, degrees of irritation vary significantly from individual to individual. The human system is capable of metabolizing small quantities of formaldehyde with no difficulty. As the dose or the level of exposure increases, the body cannot handle this increase, and at some point, the human detoxification mechanism becomes overloaded. Formaldehyde,

therefore, at some level of concentration, becomes an irritant. I find further that as this abrasive level of exposure is increased, the exposure level becomes toxic. Usually the sensory nerve system of the eye first becomes affected. Upon a sufficient dosage, discomfort and/or tearing will result. At varying appropriate levels, a person's respiratory system is subject to irritation ranging initially from mild discomfort to extreme difficulties and finally to fatal results as concentration levels increase. Symptoms which are typical of overexposure include not only such eye lacrimations and respiratory irritations, but nose irritation, coughing, dry throat, headaches, nausea and drowsiness. Also typical is the fact that such symptoms usually promptly disappear once exposure to the offending level of formaldehyde ceases. I find as a fact that all of the twelve symptoms enumerated in the Repurchase Regulations at 105 CMR 650.222(E)(4)(f) are in fact symptoms commonly associated with overexposure to formaldehyde, excepting "ear irritation" (listed as number 11) which I find is not a symptom commonly associated with such exposure. However, I also find as a fact that each of the eleven symptoms have many other common causes, both bacterial and viral in nature, or result from other pollutants. Therefore, each of these symptoms, and many combinations of them, whether of the respiratory or other septemic system, can be caused by numerous irritants, infections, or allergies. Diet, disease and depression are also causes for these symptoms.

Given the enormity of industrial, commercial and residential usage of urea formaldehyde resins, the paucity of research on the question of possible chronic consequences of exposure at various levels of formaldehyde is somewhat surprising. There is a significant need acknowledged by those within this particular field of expertise for additional toxicity studies which concern themselves with chronic effects, if any, of minimum long term exposure, the evaluation of primary irritant effects on the repair mechanisms of the body, particularly respiratory tissue, the effect of age in the response to exposure dosage, the chronic effects, if any, and the concentration-response relationship in selected persons involved in the chemical and manufacturing industries concerned with formaldehyde. Simply stated, I find as a fact that the present data bank on the toxicology of formaldehyde is too deficient to permit the fixing of exact toxicological standards for formaldehyde exposure based upon reasonable scientific certitude for either the many various industrial or residential environments. I find further that there is in fact a population threshold for the irritant effects of exposure to formaldehyde in homes. Moreover, from the toxicological evidence produced at trial, I find and conclude factually that residential exposure to formaldehyde at levels below 0.1 parts per million is an exposure beneath this undetermined population threshold. I further conclude, insofar as it is a question of fact, that from the data made available to the Commissioner and presently found within its administrative record there is no evidence upon which an agency fact finder would be warranted

in concluding that the population threshold for irritant or toxic effects of exposure to formaldehyde is zero.

However, these findings of fact are not dispositive of the underlying issue of this litigation, which is, does UFFI cause health problems. Epidemiology is the study of patterns of illnesses within communities, work forces, and other selected population groupings. An epidemiological study would permit a scientific analysis as to the likelihood or improbability of UFFI causing health problems. Such a study compares a selected or subject group (i.e., residents in UFFI homes) with a second or so-called "control" group (i.e., residents in non UFFI insulated homes), monitors certain health symptoms as they appear and are examined by particular members of each group, collects the same and compares the incidence of symptoms between the two. The Commissioner could have caused an epidemiological study to have been had with the information that he possessed, but he elected not to compare the alleged health effects experienced by UFFI residents with the incidence rates for the general public. He did not rely upon any epidemiological evidence whatsoever. Indeed, not only did he not compare any such rates with incident rates in the general population, he simply did not know the incident rates within the UFFI group. He also was without any knowledge as to how many people experienced or with what frequency they experienced adverse health effects as a result of UFFI emitted formaldehyde. Similarly, at trial, just as the Commissioner in promulgating his regulations did not rely upon epidemiological evidence, the Commonwealth did not advance the same as grounds in the court for upholding the

regulations. However, the Commissioner did introduce an epidemiological study conducted by the New Jersey State Health Department (after the Commissioner promulgated the Ban Regulations). This study compared symptoms experienced by members of households living in 400 homes insulated with UFFI with symptoms experienced by members of households living in 400 control homes without UFFI. This study shows that many symptoms are more prevalent in individuals living in houses without UFFI than in individuals living in houses with UFFI, all as more fully appears in Exhibit 72 at 12, at Table 9. Interestingly, the prevalence data obtained by the New Jersey State Health Department show a greater overall frequency of health complaints in the control population than in the UFFI population.

Therefore from the epidemiological evidence produced at the trial, insofar as the same is a question of fact, I find there has been no showing that the symptoms focused upon are more prevalent among individuals living in UFFI houses than any other group of residents.

VIII

FINDINGS OF FACTS MADE REGARDING THE CIRCUMSTANCES LEADING UP TO THE PUBLIC HEARING

Sometime in the spring of 1978, certain Massachusetts residents who had UFFI inserted within their homes made some complaints. Some made complaints to the Executive Office of Consumer Affairs. Others made their grievance known to the Consumer Protection Bureau within the Department of the Attorney General.

In June and July, members of the Department of Public Health collected air samples from some approximately seventy of these homes. Urea formaldehyde foam insulation and the extent of its "off-gassing" and the consequences upon human beings became a matter of considerable public discussion, all as more fully appears from Opponents' Exhibit 40 and Exhibit 1, Volume IX, pages 87 to 155. Therefore, a "task force" so-called, of various state agencies, chaired by the Secretary of Consumer Affairs, was organized. The National Association of Urea Formaldehyde Insulation Manufacturers (hereinafter called NAUFIM) was formed. In early August, the state released the survey result of the homes which were the subject of consumer complaints. Seventy-three homes had been tested for formaldehyde emission, with sixteen having been found to have "abrasive levels emitted".

Deputy Commissioner David Kinloch was primarily responsible for the Department of Public Health's investigation of UFFI

until he left the Department in the summer of 1979. In August, 1978, the then Deputy Commissioner Kinloch stated that levels of formaldehyde "less than 0.1 ppm would generally not be associated with health problems. Levels between 0.1 and 0.5 ppm could, but are usually not problem causing." On August 10, 1978, Deputy Commissioner Kinloch wrote a memorandum to local boards of health indicating that the Department considered that formaldehyde at levels less than 0.1 ppm would not be associated with any symptoms.

By August 11, 1978, NAUFIM was given a list of twenty-nine specific complaints. On August 18th, 1978, the Department announced a $10,000.00 grant to conduct further air quality tests to measure formaldehyde vapor in UFFI homes, other homes, and various outdoor sites, with the testing to be completed as of September. In fact, there was no such grant ever made, and consequently, no such testing ever undertaken.

The task force met with the industry task force, NAUFIM, on July 26, 1978, and it was agreed that NAUFIM, one, would measure formaldehyde and see that any appropriate remedial action was taken, and two, that the state would follow up with the homeowner, and three, if the state investigation showed the need for further work, NAUFIM was to be advised.

Both the Department of Public Health and the Executive Office of Consumer Affairs were not satisfied with the responses from the industry. These agencies issued a joint letter, dated November 17th, 1978, which was entitled "Important Notice Concerning Distribution and Installation of Urea Formaldehyde Foam". In this document, the two agency combine sought, one, a complete list of Massachusetts customers with the date of the UFFI installation; two, the test results and methodology of the same regarding air or foam taken from homes in Massachusetts; three, a statement of industry opinion as to the safe level of formaldehyde; four, an industry appraisal of the accuracy of the Commonwealth's testing; five, a list of the industry's proposed remedies in the event a problem is found; six, a complete list of Massachusetts installers and retailers; and seven, the chemical composition of each "remedy". (This Court does not know whether the use of the term remedy was intentional or whether what was meant was in fact the chemical composition of the various foam products.) The agencies also wanted any industry analysis which demonstrated that the chemicals used in these "remedies" are safe for consumer use. More importantly, this November 17, 1978 communication urged the industry to "voluntarily suspend the distribution and installation of UFFI"

until the industry could demonstrate "adequately" to these agencies that any and all foams in use were safe and that there was an industry ability to rectify "promptly and completely" any problems that had been identified in past installations.

Then, at a time more than three months before any hearings, the Commissioner of Public Health and the Secretary for Consumer Affairs, on December 5, 1978, issued a public statement regarding the dangers that they perceived to be associated with UFFI, and warning Massachusetts inhabitants against its use. At about the same time, the Attorney General issued a public warning, and pursuant to the provisions of Chapter 93A, gave a statutory five-day notice of his intention to institute proceedings. This notice to the industry that proceedings under the Consumer Protection Law were about to begin resulted in representatives from industry thereafter meeting in negotiations with the Attorney General on a continuing, but sporadic basis until February, 1979.

On February 29, 1979, the present Commissioner of Public Health, whose term had commenced in January, announced that his department would hold late March hearings "on a proposal to ban the sale of urea formaldehyde foam insulation in the Commonwealth". The Commissioner stated that three sources; available information,

the Department's analysis of its own testing, and a consultation with the Executive Office of Consumer Affairs had led to the belief "that the insulation foam precipitates too many health problems suggestive of formaldehyde irritation to families".

This public statement deserves closer examination. First, the Department's own testing has been the subject of this Court's finding early in the decision wherein it was found that the 198 tests all revealed formaldehyde levels of less than .5 parts per million parts of air and no testing ever compared the formaldehyde levels of indoor ambient air of UFFI and non UFFI homes. Second, what repository of knowledge was within the Executive Office of Consumer Affairs led the Commissioner to his stated belief? From about mid 1978, the Executive Office of Consumer Affairs had publicized its "Office of Self Help" as a willing repository for consumer complaints dealing with this subject. Thereafter, there were a total of five hundred and eighteen calls regarding UFFI, of which this office designated over three hundred and fifty as complaints, notwithstanding that some of these callers had merely sought a formaldehyde level test. Later on, the Office of Consumer Affairs sent out a four-page questionaire to some of these consumers and received certain replies. Neither the percentage replying nor the content and comments, or lack

thereof, were ever fully disclosed prior to or at the time of the public hearings. (See Proponent's Exhibit 64; Volume V, p.192 of Exhibit 1.) However, what is clear is that the number of questionaires is not near 400, that the number of questionaires does not approximate 358, which was the number of complaints later asserted by the Executive Office of Consumer Affairs, and that the numbers are not presently known. In any event, these questionaires were deemed by the Commissioner in his findings to be lacking in probative value and content.

Therefore, the third ground or source which the Commissioner cited publicly, , "available information", assumes considerable importance. This is an enumerated ground for his belief that "insulation foam precipitates too many health problems". I find as a fact that when the Commissioner stated the same as a basis of his belief that he meant that information within public availability which he anticipated would be forthcoming in the hearings he was then scheduling. More particularly, this finding is strengthened by the very next sentence in this public utterance: "I believe these hearings will serve as an excellent forum to discover the wide spread health effects of foam insulation." It is important to note that he did not describe the information upon which he based his belief other than to say it was "available". It is also important to emphasize that

he considered the hearings as an appropriate way to "discover" these widespread poor effects. Therefore, the evidence supports and I draw the inference that on February 22, 1979, prior to the scheduling of any public hearing, the case against UFFI had been prejudged.

IX

FINDINGS REGARDING THE PUBLIC HEARINGS OF MARCH 29 AND MARCH 30, 1979

On March 7, 1979, the Commissioner of the Department of Public Health gave notice of the public hearing "on proposed regulations concerning the banning of urea formaldehyde based, foamed-in-place insulation from commerce within Massachusetts ..." The purpose of the hearing was ". . . to receive written and oral testimony . . ." on these proposed regulations. This public hearing was scheduled to be held on Thursday, March 29, 1979, at 10:00 A.M. A second day was conditionally further provided, to wit, ". . . and, if necessary, Friday, March 30, 1979." Written testimonial submissions could be made prior to the hearing by delivery to a named employee of the department, and also, copies of the proposed regulations would likewise be furnished by that particular employee. However, it was expressly stated "all written testimony must be submitted no later than March 30, 1979, unless such time for submission was expressly extended."

NAUFIM, Borden, C. P. Chemical, Acrolite and others objected to this procedure, and there was a series of communication from these persons both before and after a March 14th meeting between NAUFIM and the Department. Principally, the

representatives of industry and some particular makers objected to the short time between the hearing notice and the hearing date. As a factual matter, this period of time is the shortest permissive time period that is articulated in Chapter 30A, Section 2. The Department settled on a procedure for this hearing wherein the proponents of the regulation would have the morning sessions, while the opponents would have the afternoons of the 29th and 30th. The public hearings would run from 10:00 to 5:00, with a short lunch break. However, there was to be no automatic fifty-fifty split of the time. This discussed organizational format also was to include a panel of persons who had expertise in the areas relating to the proposed regulations, and who could query those who appeared to offer testimony.

The industry representatives were not given copies of the consumer complaints, nor were they given any opportunity to discuss the test methodology utilized by the Department of Public Health in assessing the levels of formaldehyde in the 198 homes which had been surveyed. No meaningful discovery permitted. More particularly, the industry, Borden, C. P. Chemical, and others requested an adjudicatory hearing, and further argued that there had to be some consideration of environmental impact. These contentions were reduced to written motions, as, for example, a motion to withdraw the proposed

regulations, a motion for adjudicatory hearing, a motion for certain procedural rights.

At the hearing of the March 29th, 1979 hearing, the presiding officer, one Rodman, commenced the public hearing with the following statement:

> "The purpose of this morning's hearing is to take written and oral testimony pursuant to Department of Public Health proposed regulations concerning the banning of urea formaldehyde foamed-in-place insulation.
>
> "We have a number of people who have already signed up this morning. If you were here this morning and wish to give oral or written testimony, please place your name on the list which is found in the very back of the room on the middle table. Due to the large number of people who have signed up, we might not have an opportunity to call everybody today or even tomorrow.
>
> "For that reason, the department will reserve the right to extend the time for this hearing to next week and further if necessary. If the hearing is extended until next week, it will probably take place on either Wednesday or Thursday. When you do sign up, please put down your name, address, affiliation, and telephone number, so that the department can call you and arrange for specific times for you to testify, if you're not to testify either today or tomorrow.
>
> "The department intends to keep the record open for this hearing for 14 days following the closing of the hearings, which is now scheduled for tomorrow. Unless the department rules otherwise during the course of the proceedings, the record will close 14 days from tomorrow.
>
> "All people who are to speak this morning will be timed. You will be given approximately a one minute warning when your time is about up. We will have a timer. When the bell rings, your opportunity to testify is finished and please do not testify past that point. Utilize the minute that you have for completing your testimony.

"We have here this morning a panel of people who are prepared to ask questions of witnesses which will assist the department in understanding the parameters of the problems involved; and on the hearing panel this morning are Mr. Harold Bayley, seated in the middle, director of the Division of Occupational Hygiene, Department of Labor and Industries. Mr. Gerald Billow, general counsel for the Department of Public Health seated at the far right. And to my immediate right is Dr. David Kinloch, deputy Commissioner of the Department of Public Health. I'm Gerald Rodman, hearing officer of the Department of Public Health.

"The purpose of this morning's hearing is solely for the purpose of taking oral and written testimony. This proceeding is not an adjudicatory proceeding. We are not here this morning to engage in debate or to answer questions. We are simply here for the purpose of receiving testimony and asking certain questions of people which will assist us in making our determinations."

The first order of business was the motions of NAUFIM and Borden. The disposition of these motions was rapid.

"We have a number of formal motions which have been made by representatives of the urea formaldehyde foam industry. I'd like to take just a few minutes to respond to these particular motions. The department does not consider these motions to be appropriate in the context of this public hearing, but for informational purposes and to assure that all parties are clear as to the conduct of this proceeding, we will rule on the motions as follows.

"The industry has moved that the department withdraw its proposed regulations. That motion is denied. The industry has moved for certain adjudicatory hearings with respect to the subject matter of this hearing. Those motions are under advisement. This does not affect the conduct of this hearing today or tomorrow or on any extended day, and it should be made clear that these hearings today and tomorrow are not adjudicatory in nature.

"The industry has made some further motions for certain procedural rights. Those rights are as follows.

One, the right to cross examine witnesses. That motion is denied. Two, motion to file supplementary material for 30 days after the closing of this hearing. That motion is denied. As previously noted, the record will be left open 14 days from tomorrow, unless the department otherwise notes during the course of this proceeding.

"Three, the industry has made a motion to inspect and copy certain documents. The department does not rule upon this, but rather states that the department has and will make available to all members of the public all documents which are matter of public record. Four, the industry has made a motion to compel an interview with a certain member of the Department of Public Health. That motion is denied.

"This morning additional motions were filed by Borden, Inc. They seem to parallel the motions which were filed yesterday on behalf of NAUFLM, which we just responded to. Those motions are motion of Borden for certain procedural rights. Motion of Borden that department withdraw certain proposed regulations. Motion of Borden to have a certain adjudicatory hearing.

"To the extent they are duplicative of the rulings we made, the same ruling shall stand for those motions. To the extent we have not ruled upon motions or our rulings are in any way inconsistent with the rights of any parties here this morning, then all rights are reserved for those parties. Your objections are duly noted and recorded."

The proponents of the regulation then went forward with the Secretary of Consumer Affairs, who first offered testimony and exhibits, and then turned over the presentment of this cause to the Coordinator of Consumer Activities, one Barbara Neuman. Thereafter, Barbara Neuman offered testimony and introduced the proponent's witnesses. All testimony was unsworn and not the subject of any cross-examination. It was subject to time

limitations, and witnesses were warned when time was running out. Those who were not brief enough to avoid a time cutoff could submit a more detailed written statement. To the extent permitted, Borden and others participated in the hearing.

During the afternoon proceedings on the second and concluding day of the public hearing, counsel for Borden protested an attempt by the Secretary of Consumer Affairs to impeach the credibility of a prior industry witness, one French. She had asserted that a lunch break check of an undisclosed complaint file to which she denied industry access revealed French as inaccurate and, inferentially, untruthful.

> "MR. CURTIN: Good afternoon. My name is John Curtin. I'm with the firm of Bingham, Dana & Gould, and we represent Borden's in this proceeding. Borden's would like to present three witnesses this afternoon, but before I do so introduce our first witness, I would like to make one comment for the record.
>
> "As you are aware, we have filed a motion for an adjudicatory hearing. That motion as I understand it is under advisement. I would like to echo the comment of Attorney Rosenberg, but also I would like to specifically point out that there has been an effort made in just the last few minutes to impeach a witness specifically by reference to an undisclosed complaint file, which is clearly a matter for the adjudicatory hearing.
>
> "And I would also point out that there has been an effort made in the opening statement of the Secretary of Consumer Affairs to single Borden's out by reference to testimony of one witness referring to notes of some other unnamed and apparently deliberately excised person

referring to comments by two other witnesses. So you have a triple hearsay situation in which one company is singled out.

"I submit to you by any standards of due process that requires the right of cross examination and the right of an adjudicatory hearing."

The hearings closed shortly after six o'clock on the evening of March 30, 1979, with the hearing officer reminding those present that they had fourteen days within which to submit any further writings to the agency.

X

FINDINGS CONCERNING THE SCOPE AND CONTENT OF THE ADMINISTRATIVE RECORD

First there was evidence from which the Commissioner would have been warranted and from which he did conclude that formaldehyde vapor is emitted from UFFI. Certainly improper installation may be a cause of such emission,. and indeed the Commissioner concluded that "the evidence suggests" the same. However, though somewhat scanty, there was evidence from which the Commissioner could and apparently did conclude that properly installed UFFI emits formaldehyde. The Commissioner did not distinguish as to whether the emission was of free formaldehyde or as a result of hydrolysis, or whether he intended to include both. The word apparently is used by this Court because what the Commissioner did was to shift the burden from the proponent to the defendant industry on this issue, as witness his conclusion as found on page 98.

> "Opponents have claimed that proper installation will eliminate formaldehyde . . . (but) . . . have not substantiated these claims with scientific tests or other evidence . . . (nor) . . . demonstrated UFFI can be properly installed . . . Nor do I have evidence showing what installation procedure will control vapor problems or whether these procedures will eliminate vapor emissions from the insulation. I therefore cannot conclude that improper installation necessarily accounts for the formaldehyde problems experienced in UFFI."

In any event, his finding on this issue is found on page 37 of his summary, and it is:

> "Overall the evidence submitted indicates that UFFI releases formaldehyde. The amount of formaldehyde vapor that this emission may cause in ambient air in UFFI homes depends upon a number of factors and is not quantifiable based on the evidence available."

Since the Commissioner did not qualify that finding, neither does this Court, and it is treated as such; to wit, all UFFI releases formaldehyde. Although the Massachusetts CAT tests of his department do not support such a conclusion, there is within the record other evidence which would.

Second, there is no evidence in the administrative record which could support a finding as to how much such vapor is off gased from the foam to any indoor environment. Not only, as mentioned earlier, are the quality, age, handling of the products, method of installation and temperatures important, so too is ventilation, vapor barriers and other physical characteristics of the home. Urea formaldehyde resin contained in a multiple series of home products may also be emitting vapor, the Commissioner stated.

> "We lack tests controlling other factors that affect the vapor emission properties of the foam such as temperature and humidity conditions, portion of home insulated, installation technique, etc. We also lack tests isolating UFFI-caused vapor from vapor present due to other sources of formaldehyde within the house."

From these two given propositions, the Commissioner justified the ban. He simply concluded any emission of formaldehyde is too much. He reasoned in two ways. The first involves shifting the burden away from the proponents of the ban and depositing it upon the industry without notice at the time of the hearing, but by announcing it in the summary of his findings as unsatisfied. The burden is upon those who would be regulated to demonstrate some "level of formaldehyde vapor that has been proven safe up to twenty-four hours per day, seven days weekly, over an individual lifetime" and the Commissioner concludes that no such level whatsoever had been so proved.

The second reasoning method used by the Commissioner was to review certain data to draw certain conclusions. He reviewed three laboratory tests of UFFI and concluded UFFI emits formaldehyde. He then reviews some nine tests showing the amount of aldehydes or formaldehydes in UFFI homes (although he concedes they offer no "proof that the formaldehyde detected in fact issued from UFFI" as distinguished from any other one of the multiple possible sources of emission) and concluded UFFI emitted into homes formaldehyde vapors in an amount "not quantifiable". Next he reviewed animal studies, occupational standards, and expert opinions. He concluded that the "full extent of the danger posed by long term low-level exposure to formaldehyde in homes

remains unknown." Next he reviewed the testimony offered by the nineteen consumers and concluded that the majority of them had symptoms caused by formaldehyde exposure; that this majority was symptom free until their houses were insulated; that these symptoms disappear when the environment was changed; therefore, the Commissioner's inference that UFFI either "caused or significantly contributed to "these particular symptoms". He also found that this "majority" is "a substantial number in and of itself". At this point in the Commissioner's conclusions, he had to make a large supposition, and he did. "In all likelihood, substantial numbers of other persons are similarly affected."

It should first be noted that this Court found above in part VII hereof that while the present state of the toxicological and epidemiologic data is not sufficient to fix with a reasonable scientific certitude a population threshold or level for the irritant effects of residential exposure to airborne formaldehyde, that nevertheless, there is factually an acceptable level for human exposure with presently a wide disparity of opinion within the scientific community as to where this level should be drawn. It is important to point out that these two findings were made by this Court upon all of the evidence produced at the trial. Finally, from the evidence

presented, this Court concluded that exposure to formaldehyde at levels below 0.1 parts per million from the evidence at trial is beneath this still undetermined population threshold.

This Part X is concerned with findings concerning the scope and content of the administrative record. Therefore, with respect to that record, this Court now finds that from all of the data collected and testimony offered on the administrative record, there is no evidence which would warrant the Commissioner from finding that the population threshold or the level of public tolerance to exposure to residential formaldehyde is a zero basis. No one opined that each, every and all exposures are irritating or are toxic.[1/]

The Commissioner classified formaldehyde as an irritant and toxic without reference to any concentration level. The

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1/ I find that the strongest support for the Commissioner's ultimate conclusions within the administrative record is the statement made by a certain Dr. Alarie, a physiologist, who has published extensively on the results of animal research, developed methods for measuring sensory irritation in rodents and who found that mice exposed over time to 3.2 ppm formaldehyde experienced respiratory decreases up to fifty percent of normal. He therefore postulates that man should take safely only one-tenth or prererably one-hundredth of that level. In accordance with his thesis, Alarie stated during the public administrative hearing, "In recommending a level which should dictate the highest concentration of formaldehyde to be existing in homes, .03 parts per million is the highest concentration of formaldehyde to which inhabitants of homes in any state in the U. S. should be exposed and preferably a level of .003 parts per million should be observed."

Commissioner found that the aged, the very young, the allergic, the asthma prone, and those suffering chronic respiratory disease may be more susceptible than the general population. However, this does not alter or change the two basic facts; to wit, there is a dose-response curve for formaldehyde; and there are concentrations of airborne formaldehyde at which people generally, including the elderly and young, will not experience any irritation as a result of exposure. In fact, there was no scientific evidence produced at the administrative hearing that children or the elderly are more susceptible than the general population to airborne formaldehyde. Moreover, all of the evidence collected in the administrative hearing showed there is a general population tolerance threshold that exists.

The Commissioner not only lacked any factual basis for his conclusion that "in all likelihood substantial numbers" are affected, he admitted the same many times in his summary. See, for example: "We lack epidemiologic and clinical studies of the long term effects of formaldehyde vapor on humans . . . The number or studies is few." (See p.45 of Tab 4, Exhibit 1.) "In toto, this evidence does not permit us to determine with any degree of accuracy the contribution made by non-UFFI products to the formaldehyde problems." (See p.72 of Tab 4, Exhibit 1.)

"Knowledge of the precise number of persons affected by UFFI would not allow me to determine the frequency of the occurrence problems caused by UFFI unless I also knew the number of installations of UFFI in Massachusetts . . . I have no reliable estimate of that number . . ." (See p.82, Tab 4, Exhibit 1.)

In sum, there was no evidence upon which the Commissioner would have been warranted in finding, 1) the ambient levels of formaldehyde in houses with UFFI to be materially different from houses without UFFI, 2) what percentage of incident rate of complaints is attributable to faulty installation, 3) what was the incident rate in UFFI homes; moreover, what was the incident rate in UFFI homes as compared to non-UFFI homes. Insofar as the same be a question of fact, I find the Commissioner had no basis for concluding that a significant number of individuals may incur significant harm as a proximate result of exposure to UFFI.

The Commissioner defended his lack of knowledge by blaming the UFFI industry. The Commissioner stated, "The Commonwealth has attempted to secure complete lists of Massachusetts installations of UFFI without success . . . The absence of a reasonably complete list has thwarted the Commonwealth's attempts to perform an epidemiologic study."

I find as a fact that this specific representation within the summary regarding thwarting any attempt to perform epidemiologic studies is not credible, and I give this justification neither reliance nor weight. The administrative record assembled would easily have permitted the gathering of a sufficient UFFI group (for example, the 300 UFFI homes suggested by Dr. Landrigan and referred to by the Commissioner in his summary). As factually found by this Court earlier; the Commissioner could have caused an epidemiological study to have been done with the information he possessed, but he elected not to compare the alleged health effects experienced by UFFI residents with the incident rates for the general public. The Commissioner testified, and I find, that the study publicly announced in 1978 to do just such a comparison was not done because it was never funded by a sufficient appropriation or grant. More particularly, the administrative record of this hearin contains no request by the agency to any interested party to present such specific data for consideration either at the public hearing, during it, or thereafter, during the period of time that the record was left open; or at any time thereafter until the regulations were promulgated in November. (The general public demand made by the joint agencies of Consumer

Affairs and Public Health in November 17, 1978 for, among many other items, a complete customer list, was made in connection with a suggested voluntary industry wide ban that was then being urged. I assume it was this demand the then Commissioner referred to in his summary. Given the possibility of legal action under Chapter 93A, and there were no then contemplated hearings under Chapter 94B and that the list was to be furnished to Consumer Affairs as was all the other information demanded generally, it cannot be contended that the November 17, 1978 public pronouncement is the substantial equivalent to a request by an agency for information in connection with a public hearing concerning a disputed matter which was to be resolved by that agency.)

It should also be pointed out that after these hearings terminated, the Commissioner, in his first public announcement of the ban, announced,"The Department of Public Health estimates that some 4,000 homes in the Commonwealth have been insulated with UFFI insulation."

FINDINGS CONCERNING THE DECEMBER 1979 AND AUGUST 1980 PUBLIC HEARINGS

On November 1, 1979, the Commissioner issued regulations effective November 14, 1979, 105 C.M.R. Sec. 650.000, which banned the sale of UFFI, required its "repurchase" in certain circumstances and declared formaldehyde to be an "irritant" and a toxic and hazardous substance without regard to any concentration level of formaldehyde. When he announced the Ban Regulations, Commissioner Frechette issued a press release dated November 1, 1979, in which he stated that the problem with UFFI was one of "excess formaldehyde vapor in homes insulated with UFF." In referring to "excess formaldehyde vapor", Commissioner Frechette in fact was making a reference to the federal occupational standard promulgated by OSHA, 3.0 ppm eight-hour time weighted average. About two weeks later, November 16, 1979, the Commissioner stayed the effective date of those provisions of the Ban Regulations which governed the "repurchase" and removal of UFFI until February 14, 1980. Then, on November 20, 1979, he scheduled a further hearing to consider the "repurchase" and removal provisions. Once again, Borden, C. P. Chemical and others moved for

adjudicatory rights, for certain procedural rights and safeguards, requested the Commissioner to disclose all ex parte contacts since the March, 1979 hearings; and, moved that the proposed regulation be withdrawn. Borden also urged withdrawal, inter alia, that there was no basis for finding that its product Insulspray had caused any adverse health efforts or that Insulspray emits appreciable quantities of formaldehyde. These motions were all denied and the hearing was held on December 19 and 20, 1979. Borden participated in that hearing to the extent permitted. Other manufacturers also took part to the extent permitted. C. P. Chemical joined with Aerolite, Celsius, Cennco, Rapco and others and sought to have the repurchase regulations withdrawn, or in the alternative, to postpone their effectiveness until there was a final judicial determination as to the propriety of the ban. C. P. Chemical also filed for an adjudicatory procedure before the hearings. There was no transcription taken of the public hearings on December 19 and 20, 1979. Although the public notice asserted written comments had to be received by December 18, 1979 "unless the deadline is expressly extended" it is obvious from Exhibit 19C that writings were later accepted. (See, for example, p.178 of Exhibit 19C.)

Nothing happened for six months, excepting only that the effective date for the repurchase regulations were extended on four separate occasions.

On July 3, 1980, the Commissioner gave notice of a hearing to be held on August 1, 1980, regarding the "regulations concerning re-purchase of urea formaldehyde foamed in place insulation". He also directed any interested party to a named employee who would furnish a copy of the regulations or accept comments received before July 31, 1980. Comments were in fact later received.

The August 1, 1980 hearing was not transcribed in any manner. C. P. Chemical, Borden, and others renewed their previous motions, and Borden filed a lengthy document in an attempt to preserve a record. Once again, no adjudicatory rights were accorded in the August 1, 1980 hearing.

After the August 1, 1980 hearing, the Commissioner continued the effective date of the "repurchase" and removal provisions on two further occasions and then, on November 6, 1980, issued new "repurchase" and removal provisions with an effective date of November 20, 1980, 105 C.M.R. Sections 650.200, 650.222 (the "Repurchase Regulations" and, with the Ban Regulations, the "Regulations").

FINDINGS CONCERNING THE SCOPE AND EXTENT OF THE ADMINISTRATIVE RECORD RE DECEMBER 1979 AND AUGUST 1980 HEARINGS

A judicial review of the administrative data collected by way of the statements given at the public hearings and matters submitted in connection therein cannot be accomplished, since the administrative record is not complete. The public proceedings were not preserved nor transcribed or recorded, and therefore are not retrievable. However, the written materials submitted have been examined.

In promulgating the repurchase regulations, the Commissioner continued to be without any knowledge of the number of UFFI homes within the Commonwealth, and ignorant of frequency of or incident rate with which the occupants of UFFI homes experienced symptoms. Once again, there was no information furnished which would permit, and no attempt made to make comparisons of incident rates between UFFI and non UFFI residents. No epidemiologic study was done. Indeed, formaldehyde concentrations within UFFI homes were still not compared with formaldehyde levels in the outside ambient air. The administrative record reveals no additional information was supplied regarding potential emission sources. Therefore, in promulgating the repurchase regulation, the Commissioner was without knowledge as to quantifying the contribution of UFFI emitted formaldehyde to the total emission level within any UFFI home.

Since the Commissioner remained unable to draw certain necessary conclusions which would be grounded or warranted from the administrative data collected (as, for example, 1) the extent of UFFI emission, 2) as to the contribution of other urea formaldehyde resin products commonly found in all residents and 3) the number of persons affected, to name just three) the approach taken in promulgating these repurchase regulations remained the same as utilized in the ban regulations; to wit, the burden was upon industry to prove formaldehyde safe up to twenty-four hours a day over an individual lifetime. This was a burden which the Commissioner had already found industry could not meet.

It is important to point out at this point, in promulgating his regulations (ban and repurchase) the Commissioner required industry to rebut his inference that the health symptoms allegedly suffered by nineteen persons were caused by exposure to UFFI emitted formaldehyde. The complaints upon which the Commissioner relied were only those in which there was either a statement made at the public hearing or submitted as a writting and made a part of the administrative record. Of these nineteen, it is obvious that some of these lived in homes in which the UFFI had not been correctly installed. Two of the

complaints involved Borden's product Insulspray, and one of these complaints clearly was an improper installation. None of these complaints involved C. P. Chemical's product Tripolymer.

Attention is now called to the Commissioner's "Comments Concerning Repurchase of Urea-Formaldehyde Foam Insulation" at page 4 thereof under paragraph entitled "b". This statement appears: "The long term effects of formaldehyde exposure remain unknown and were not relied upon by the Commissioner in banning UFFI." This statement is of considerable importance and deserves closer examination.

As a prerequisite to such examination, three factual findings are made at this point. (1) I find as a fact from the evidence produced at trial before me that the effects of exposure to formaldehyde at levels of 0.5 parts per million or less are not cumulative. I find further, insofar as it is a question of fact, that there is nothing in the administrative record which would warrant the Commissioner from concluding that exposure to formaldehyde at a level of 0.5 parts per million is cumulative. (2) Next, I find as a fact from the evidence produced at trial before me that the threshold to formaldehyde irritation does not vary according to the duration of exposure. I find further, insofar as it is a question of fact, that there is nothing in the administrative record which would warrant the Commissioner

from concluding that, whatever the threshold tolerance to formaldehyde may be, that level would vary according to the duration of exposure. Simply put, it is the dosage not the length of time which has significance to the tolerance level. (3) Lastly, I find that the human body has within it an immunological system. Suffice to say that upon sufficient exposure to formaldehyde or any number of other substances, this bodily system may activate itself. Most experts agree, and I find, that formaldehyde has sensitizing properties. When a person has such an immunological response, it is called sensitization. The effect of this sensitivity is not only to increase the severity of the symptoms experienced, but upon subsequent exposure, to induce such symptoms even when such a subsequent exposure is only of minute or even of trace dosages of the compound involved. I also find that there was evidence in the administrative record which supports the finding that the Commissioner made that "Formaldehyde therefore is not a 'strong sensitizer' within the meaning of the statute."

Having in mind the above three factual conclusions, the Commissioner's "Comments Concerning Short Term Health Effects" (Page 2, Exhibit 1, Tab 5) might be expected to reveal a simple relationship between those twelve symptoms later enumerated in the regulations as characteristic of formaldehyde exposure and

those symptoms representitive of "the 'majority' of the complaints" earlier set forth in the bar regulations as caused by the "toxic" and "irritant" characteristics of UFFI-emitted formaldehyde. Bear in mind, all of the "majority" symptoms are dose related, and, being under 0.5 parts per million, not cumulative in effect.

However, when the Commissioner in his summary on page 4 discussed "Short Term Health Effects" the Commissioner states under that paragraph heading the following:

> "The original regulation was intended to protect those people who were suffering and those who perceived themselves to be at risk due to UFFI . . . The Commissioner noted in . . . (his earlier ban) . . . summary for example that there is no known safe level of exposure in homes; once sensitized, some individuals may react to minute or trace doses. . . ."

This Court finds, insofar as the same is a question of fact, that the Commissioner's conclusion as set forth above from his repurchase summary is inconsistent with the Commissioner's earlier conclusion set forth as found in his ban summary and quoted below.

" . . . The Massachusetts statute mandates a finding that formaldehyde has a significant potential for causing hypersensitivity based on the frequency of sensitive reactions as well as severity of the response. Lacking evidence of the number of individuals experiencing hypersensitive reactions, there is no basis for coming to a conclusion about the frequency of hypersensitivity."

I find therefore insofar as it is a question of fact, in assessing health effects generally or in assessing what the Commissioner calls "short term health effects" any consideration of sensitization in connection with the repurchase regulations was and is improper.

Next in summarizing "Short-Term Health Effects" the Commissioner merely states that since "ambient air tests of levels of formaldehyde will vary", as they surely will from time to time, from place to place, depending on weather, temperature, humidity, anthropogenic activity, reaction reduction rate, tests are not necessary, the Commissioner contends, since any given tests "may not accurately reflect the amount of formaldehyde present day to day." There is absolutely no data in the administrative record to support such a finding. Such a finding is arbitrary, and capricious. Perhaps what the Commissioner meant to say in such tests

may not accurately reflect the levels of formaldehyde day after day; in other words, the cumulative effects of exposure. Insofar as it is a question of fact, I find that this is what the Commissioner meant.

Lastly, in discussing "Short Term Health Effects" the Commissioner falls back to his original basis. He refers to his original summary and "notes" that "there is no known safe level of exposure." The standard therefore is no known safe level of exposure for twenty-four hours over an individual lifetime. Therefore, although the Commissioner avoids expressing the same in explicit language, his phrase, "Short Term Health Effects" obviously includesmuch more than the twelve enumerated symptoms (which are dose related and not cumulative) and encompasses all long term presently unknown risk possibilities.

Consequently, I find the statement which was placed in the repurchase statement that "the long term effects of formaldehyde remain unknown and were not relied upon by the Commissioner in banning UFFI" to be a misleading sentence. It is true the effects are unknown, and it is true that therefore it is impossible for the Commissioner to place reliance upon such unknowns; yet the Commissioner did include these unknown possibilities, in fact, within the scope of his contemplations and fashioned both the ban and repurchase regulations so as to include all known possibilities.

XIII

FINDINGS OF FACT REGARDING REPURCHASE REGULATIONS

To initiate the repurchase procedure, an owner of a UFFI-insulated building sends two documents to the Department of Public Health (hereinafter D.P.H.). The first is a statement signed under the pains and penalties of perjury stating (1) that he requests repurchase of UFFI from a building located at a specific address; (2) that he is an owner of the building; (3) that UFFI was installed in the building, stating the date of installation, if known, and, if the person requesting repurchase is not the person who purchased the UFFI, the name of the person who purchased the UFFI, if known; (4) the present address of the consumer; and (5) the name(s) and address(es), if known, of the installer, distributor and manufacturer of the UFFI installed in the building. The second statement, also to be signed under the pains and penalties of perjury, must be provided by an occupant of the UFFI-insulated building, a former occupant, or a person legally responsible for an occupant or former occupant. That statement must state that the occupant or former occupant has suffered adverse health symptoms which occurred, or were aggravated, after the occupant or former occupant was exposed to UFFI as an occupant of the UFFI-insulated building; and that the symptoms occurred while the occupant was present in the

UFFI-insulated building. The consumer must also furnish copies of any written contracts or communications in his possession between himself and the installer, distributor or manufacturer of the UFFI product which was installed in the building.

With respect to the period of time in which repurchase may be sought, requests based upon the health symptoms of a person who was an occupant of the building prior to November 20, 1980 (the effective date of the regulations) must be made within eighteen months after the date (that is, by May 20, 1982). Requests for repurchase based upon the health symptoms of any person who becomes an occupant of a building after November 20, 1980, must be made no later than eighteen months from the date that the person becomes such an occupant. Any request for repurchase must be made, in all events, before November 20, 2000.

Once a repurchase request has been initiated, any industry member identified by the owner receives from the D.P.H. copies of the owner's documentation and notice of his right to claim review. This installer or manufacturer is given fifteen business days from the date of D.P.H. mailing in which to exercise his right of review. In any event, any industry member who receives notice from the D.P.H. of an owner's request for repurchase must, no later than ten business days after the mailing date of that notice, send to the D.P.H. a list of names

and addresses of any other installer(s), distributor(s) or manufacturer(s) whom he knows or has reason to believe were involved in manufacturing, distributing, installing or selling of the UFFI in question. When the D.P.H. receives such a list, it then notifies each identified installer, distributor, or manufacturer of the consumer's request for repurchase and each such industry member then has the right to request review. In this way, all industry members involved in a particular installation of UFFI can be identified and may request review.

Once review is requested, the owner must obtain a medical report concerning the occupant or former occupant who has suffered these allegedly adverse health symptoms. The medical report must be from a physician licensed within this Commonwealth but need not be furnished by the treating doctor. It is not submitted under oath. It shall contain a brief description of the relevant medical history and a list of symptoms, if any. It may contain a diagnosis, but there is no requirement that it include the same. Also the report may contain the foundation for any such diagnosis; however, there is no requirement that any medical opinions be expressed as to the causal relationship between the symptoms alleged and exposure to formaldehyde emitted from UFFI (or to any other source of formaldehyde emission).

In sum, the medical report does not, in fact, require the occupant or the person requesting repurchase to specifically allege (let alone prove) that UFFI caused the symptoms complained of by the occupant. With respect to the twelve symptoms ennumerated as characteristic of exposure to formaldehyde, this Court has already found that such symptoms have many diverse and possible causes.

This medical report must be furnished within six months, along with a medical authorization to permit the reporting doctor to release any written medical records which he possessed or used in making any diagnosis. The purpose of this authorization is somewhat unclear. This is so because the industry member is neither permitted to examine the occupant nor question the homeowner. The industry member cannot obtain a complete set of medical records regarding the occupant from any physicians recently visited. Results of past or present medical tests undertaken by the occupant and that patient's past medical and family history are barred by these regulations and withheld from the industry member as beyond the scope of the review afforded.

Likewise, the industry member is prohibited access to the building to test the formaldehyde level within the home, to

test for the presence of other sources of formaldehyde within the home. Indeed, the industry member is prohibited from introducing evidence as to the formaldehyde level in the outside ambient air next to the building, should such tests have been made within nearby areas to which the industry member was able to gain access. In sum, the issue of causation has, by this regulation, been effectively excluded as a defense to the industry member, since attempts to establish or prove any alternative cause for the symptoms alleged is not permitted.

What is open to the industry member is that within twenty days of receipt of the medical report and authorization, evidence may be forwarded to the D.P.H. which has a tendency to show any of the following: (a) that the person requesting repurchase is not an owner of a UFFI-insulated building; (b) that UFFI was not installed in the building; (c) that UFFI was not installed in the building on the date(s) specified; (d) that an occupant or former occupant of the building did not experience the symptoms in the time or manner claimed; (e) that the request for repurchase was not timely filed; (f) that the symptoms experienced are not characteristic of exposure to formaldehyde because they are not among the twelve enumerated symptoms listed in these regulations; (g) that the physician's signature is not

genuine; (i) that the medical report was fraudulently procured; and (j) that the industry member who requested review did not in fact manufacture, distribute, or install the UFFI in question. However, the industry member is denied access to inspect the building at issue to determine whether the UFFI insulation therein is his product. There have been occasions where contractors may have used two different UFFI insulations in the same home.

Thereafter, the owner has a further twenty days to submit rebuttal to the evidence offered by the industry member. Thereupon, the D.P.H. forwards the "evidence" to a medical and legal referee designated by the Commissioner.

The regulations specify with clarity the duties of the two referees. The medical referee shall find the occupant 1) to have in fact experienced adverse health symptoms, 2) that these symptoms were aggravated after exposure to UFFI, 3) that these symptoms occurred, but not necessarily exclusively while the occupant was in a UFFI building, and 4) the symptoms are characteristic of formaldehyde exposure. The legal referee shall find the owner is 1) the owner of a UFFI insulated building, 2) that UFFI was installed in the building, 3) that the repurchase request was timely, 4) that the occupant or former

occupant was in fact an occupier, and 5) that the industry member who is a party to the review manufactured, distributed or installed the UFFI in question. The referees conduct no physical examination, hold no hearing, ask no questions, hear no testimony, admit no additional evidence on behalf of the industry member, and permit no cross-examination. Rather, they are required to make the above findings which mandate "repurchase" of the UFFI unless the industry member (notwithstanding his inability to obtain or introduce the relevant evidence under these regulations) can produce such evidence as demonstrates "clearly and convincingly" that the occupant's statement or the physician's report is untrue.

Any industry member requesting review must pay any costs incurred by the person requesting repurchase. These costs include, but are not limited to, mailing costs, copying costs, and the cost of preparing the physician's report. In addition, this industry member must pay the costs of the legal and medical referees chosen by the Commissioner. If they fail to pay these costs within fifteen days of the mailing date of the bill for these costs, they forfeit the right of review. Further, the regulations contain no provision for recouping these fees and expenses in the event that the industry member be successful in this administrative review.

In the event the owner is successful (either without or after a review) he receives a "Certificate" entitling him to the forced repurchase of his UFFI by any one of the industry members identified in this Certificate. The owner is free to choose to which responsible industry member he shall direct his Certificate. Along with the Certificate, the owner must send to that responsible party a listing of three persons engaged in the construction business in Massachusetts whom he, the owner, deems competent and qualified to remove the UFFI and restore his building. No later than ten business days after mailing the list, the responsible party must 1) enter into negotiations with the contractors concerning a contract for removal of UFFI and restoration of the building; and 2) must notify the owner in writing that these negotiations have begun. No later than thirty days after mailing the list, the responsible party must enter a contract with one of three persons for the removal of UFFI and restoration of the building. The responsible party must pay the cost of removal and restoration as provided in the contract.

Certain minimum contract terms are specified in the regulations, including removal of all UFFI, treatment of wall cavities with a neutralizing solution if the consumer requests

it, protection of the premises from damage, and replacement of altered or damaged portions of the home with materials of equivalent kind, quality and appearance.

The regulations also attempted to cover any number of possible situations that either had already risen or which might arise in the future. These speak for themselves, and there is no need to discuss them herein.

I find that the average cost to the distributor installer or manufacturer of a re-purchase pursuant to these regulations is somewhere between $12,000 and $14,000. Additionally in some of the larger older homes the re-purchase cost in some instances will exceed $20,000.

XIV

FINDINGS REGARDING REASONABLENESS OF AN ALTERNATIVE TO THE BAN

The Commissioner found that "the installer plays a unique role in UFFI production . . . (in that) . . . the installer must 'manufacture' the insulation on site . . ." Obviously that finding was warranted from the administrative record.

With respect to installation, the Commissioner made no specific findings, but rather concluded with a general observation that the installing procedure was "complicated, possibly prohibitively complex . . ." and one which "requires often exquisite attention to detail." This Court, from the evidence produced at trial, has earlier in Part IV hereof made findings regarding installation of UFFI and the multiple factors which must be considered, and there is no need to repeat them here. While it must be conceded that there are many products in this modern technological world whose creation, manufacture, or even maintenance involve such complex and diverse skills both cerebral and acquired as to be beyond the easy understanding of either an administrator of an agency or a judicial officer, the urea formaldehyde foaming of a residential structure is not one of them. Therefore, a finding that this process is so difficult as to be a "possibly prohibitively complex" procedure

is simply not warranted by the administrative record and such a conclusion is arbitrary and capricious.

Prior to the Massachusetts ban, Tripolymer 102 had been installed in 4,649 homes and buildings in the state of New York, with a complaint rate of 0.1 percent (four complaints); in 3,843 homes and buildings in the state of Minnesota, with a complaint rate of 0.00026 percent (one complaint); in 2,623 homes and buildings in the state of New Jersey, with a complaint rate of 0.1 percent (three complaints); in 1,584 homes and buildings in the state of Ohio, with a complaint rate of 0.06 percent (one complaint); and in 760 homes and buildings in the state of Connecticut, with a complaint rate of 0.5 percent (four complaints). The product is marketed and installed in approximately twenty states. It had been installed in approximately fifty thousand homes and buildings with a national complaint rate of .026 percent. Prior to the ban, there was one Massachusetts complaint. The Department of Public Health had not prior to the ban, or to this date has not itself tested Tripolymer regarding its potential formaldehyde emission rate. Tripolymer 102 is no longer marketed, having been replaced by Tripolymer 105, an even more stable product.

C. P. Chemical Company, Tripolymer's maker, has proposed offers to enter into a consent judgment with the Commonwealth of

Massachusetts as part of these proceedings, by which it would agree to the following conditions for marketing Tripolymer within the Commonwealth of Massachusetts: (a) mandatory licensing of its installers; (b) mandatory certification by the Commonwealth of Massachusetts of its installation techniques and written instructions given to its installers; (c) adoption of the Department of Energy and Canadian standards for installation. In the event of a conflict between the requirements of such standards, the more stringent standard would become applicable; (d) mandatory testing of Tripolymer and subsequent certification to ensure: (1) that the free formaldehyde content of Tripolymer does not exceed 0.1%; and (2) that the emission rate of formaldehyde in living space is less than 0.1 ppm; (e) require that a written contract be presented to all customers and that there be a seven-day waiting period prior to execution of the contract; (f) provide a guarantee in the written contract to the customer that the level of formaldehyde within the living space will not exceed 0.1 ppm, plus known ambient level; (g) provide a guarantee in the written contract to the consumer that if it should be determined by appropriate testing that the level of formaldehyde does exceed 0.1 ppm, plus known ambient level, in the living space, C. P. Chemical Company, at its own expense,

will take the necessary steps to reduce the level of formaldehyde within the living space to 0.1 ppm, plus known ambient level, or if unsuccessful, remove the insulation from the home; (h) require that the written contract contain a warning that persons who are generally hypersensitive, sensitive to formaldehyde, generally allergic, and those with respiratory diseases, lung diseases and cardiovascular diseases, should not purchase Tripolymer insulation unless advised by their physician to the contrary; (i) require in the written contract a statement that families with children under six months of age, women pregnant at the time of installation and extreme elderly consult their physician prior to executing the contract; (j) require a statement in the written contract that if a pungent odor persists more than fourteen days after installation, the customer should immediately call C. P. Chemical Company, and further require that C. P. Chemical Company have available a qualified individual to respond to such calls; (k) require the installer of Tripolymer to assure, prior to installation, that the prospective home possesses adequate ventilation.

Borden, the other manufacturer actively participating in this litigation, and the Formaldehyde Institute, urge that licensure of installers and the promulgation of regulations

establishing installation standards are feasible alternatives which would adequately protect the public interest.

Once again in rejecting both and either of two alternatives, licensure of installers, and creation of installation regulations, the Commissioner reasoned in two ways.

First he again placed the burden upon industry. "Opponents have claimed that proper installation will eliminate formaldehyde problems in UFFI homes. Opponents have not substantiated these claims with scientific tests or other evidence . . . Opponents have not demonstrated that UFFI can be installed properly . . . The evidence suggests that improper installation may contribute . . . but does not support a finding that licensure of installers or regulation of installations procedures will eliminate the problems experienced."

Secondly, he relied upon the absence of knowledge. He rejected the three governmental standards submitted within the administrative record (the Department of Energy (DOE), Department of Housing and Urban Development (HUD) and the Canadian regulation) because these "do not state specifically which regulations are intended to control vapor emission or how the standard adopted will result in vapor control." Moreover, he found that "This lack of information is particularly

troubling." With regard to industry submissions, he likewise commented, "Nor do I have evidence showing precisely what installation procedures will control vapor problems or whether these procedures have the capacity to eliminate vapor emissions."

The Commissioner elected in this instance, also, not to open the hearings to secure additional evidence, but to proceed without that knowledge. He simply utilized both reasonings, 1) the burden is on industry, and 2) his lack of knowledge, and concluded as follows:

"I therefore cannot conclude that improper installation necessarily accounts for the formaldehyde problems experienced in UFFI-insulated homes."

In light of the language in his explicit findings, this Court now finds, insofar as it is a question of fact, that the Commissioner concluded that the administrative data was inadequate to support a finding either way as to whether or not proper installation criterion would eliminate or cure all experienced vapor problems. I also have made certain findings in Part V above regarding the suitability of licensing and regulating installation from the trial evidence (as distinguished from the administrative record) and there is no need to repeat

those findings here. It is enough to point out that the Commissioner declined to consider regulation as an alternative to banning because of a lack of knowledge.

XV

FINDINGS REGARDING OTHER PLAINTIFFS

Anderson Insulation Company has an usual place of business in Abington, Massachusetts. It is a family owned business whose business is as a supplier and installer of all types of insulating materials for a vast variety of structures. Its major market is the metropolitan area of Boston, but it also has had business in the New England States and in New York. It began using UFFI in November of 1976, and has foamed about 300 structures including churches, YMCA facilities, daycare centers, college dormitories, state buildings, restaurants and commercial structures, manufacturing plants, and the like. It has installed UFFI in approximately 265 residences. It ceased use of UFFI at the time of the banning.

The Massachusetts Installers Contractors Association is a voluntary unincorporated organization of installers of insulating materials. There were between 100 and 150 individual Massachusetts installers who used UFFI to insulate residences within this Commonwealth.

Berkshire Gas Company ("Berkshire") began promoting UFFI in 1975 for residential customers in the western part of Massachusetts. From 1975 until March 1979, approximately 518

customers of Berkshire had their homes insulated with UFFI. Initially, Berkshire would refer customers to a specific private individual installer, not affiliated with Berkshire, and approximately 122 homes were installed under such arrangements. Berkshire received a fee for each of these referrals from the private insulation contractor.

At some point in late 1976 or early 1977, Berkshire terminated that arrangement with the installer. Thereafter, Berkshire would negotiate and enter into a contract with the individual customer for the installation of UFFI and bill the customer based upon the negotiated price. Berkshire arranged to have a third party install the UFFI in the home. In turn, Berkshire paid the installer a portion of its contract price, maintaining the balance of the contract. Approximately 160 homes were insulated under these arrangements until approximately June, 1977.

In approximately June, 1977, Berkshire terminated this arrangement with the private insulation contractor, in part, because of complaints by customers about the contractor. It began to purchase quantities of UFFI ingredients from Celsius Resources, Inc., and maintained a supply of UFFI ingredients at its warehouse. From June, 1977, Berkshire continued to promote

UFFI among its residential customers and others and negotiated and entered into contracts with residential customers, and billed and received payment from residential customers for the installation of UFFI. At that time, Berkshire arranged to have a single installer, approved by Celsius, insulate each home for which a contract was made between Berkshire and a customer. The approved Celsius installer would utilize the supply of UFFI which Berkshire maintained in its warehouse to complete the Berkshire contracts with customers. Berkshire paid the installer for each job completed and maintained for its own use the difference between the customer contract price and what it paid that installer. Approximately 160 homes were insulated with UFFI under the arrangement between Berkshire and the approved Celsius installer.

After March, 1979, Berkshire did not contract for the installation of UFFI.

RULINGS OF LAW

Having found the facts, this Court sets forth separately below its conclusions thereon.

CHAPTER 94B REQUIRES AN ADJUDICATORY HEARING

Pursuant to the provisions of Chapter 94B, the hazardous substance labeling law, the Commissioner of Public Health promulgated the regulations at issue herein. His power to regulate is found within Section 2 of the Act. A banned hazardous substance is defined in Section 1. In the event an article is banned, the statute clearly provides that the manufacturer or distributor ". . . shall repurchase it from the person to whom he sold it . . . and reimburse such person for any reasonable and necessary expenses incurred in returning it to the manufacturer." Such repurchase, the statute declares, shall be accomplished ". . . in accordance with regulations of the Commissioner." See General Laws, Chapter 94B, Section 8. The hazardous substance labeling law grants to the Commissioner power to make factual findings, both as to the existence of any hazard that a specific product may pose, and, if factually found to possess hazardous characteristics, then to determine the particular degree of hazard that that substance possesses. Further, this legislative scheme mandates that in the event the Commissioner concludes a product to be a hazardous substance, then he shall consider whether the labeling and packaging of

the hazardous substance are in a form which suitably addresses the reasonable requirements of public health and safety; or whether given the scope of the risk as perceived by him, that the product is "misbranded". Misbranded hazardous substances are by this statute effectively removed from the stream of commerce by Section 3, and a violation of those provisions are made criminal by Section 4. If, however, the Commissioner finds that certain additional label requirements are necessary for the protection of public health, then he may by regulation "establish such reasonable variations . . ." However, if the Commissioner finds as a fact that an article cannot be adequately labeled so as to protect public health, or that the article presents an imminent danger to public health, he may declare that article to be a banned hazardous substance and require its removal from commerce. To accomplish the statutory purpose, the legislature has granted to the Commissioner the power to declare "by reasonable rules and regulations . . . a hazardous substance . . . any . . . which he finds meets the requirements . . ." of the defined criteria, all as set forth in Section 1. Other than the above adjective "reasonable" this grant of rule and regulation authority is not otherwise defined in those first paragraphs of Section 2. However, after reciting

the statutory schemes in those paragraphs alphabetically subdivided "a" through "d", the last paragraph appears to focus on the parameters of this grant of rule making power, "The Commissioner shall cause the regulations promulgated under this chapter to conform, insofar as practicable, with the regulations established pursuant to the federal hazardous substances act." This sentence in Chapter 94B, Section 2, does not set forth a guide for statutory interpretation; rather, that phrase is descriptive of the grant of power given therein, and is directed to the Commissioner. The legislature has mandated that in making his "reasonable" regulations, the Commissioner "shall cause" his regulations "to conform". Conform is a verb which simply denotes any undertaking to bring two objects into harmony; or, more literally, to shape or form one object in the image, outline or contour of a second object. The verb conform is directed to the promulgation by the Commissioner, and he is to shape his promulgation to conform to that standard of promulgation "established pursuant to the Federal Act." This statute charges the Commissioner to conform his regulations "insofar as practicable" with regulations established pursuant to the Federal Act. The word "practicable" connotes the

possibility of performance and has as its outer limits of performance, the lack of feasibility. In sum, therefore, the legislative requirement could be restated: The Commissioner must cause his regulations to conform to federal standards, in all cases in which it may be feasible so to do.

At this point, it would appear prudent to look at the Federal Hazardous Substance Act (15 USCA s.1261). The Massachusetts Act tracks this federal legislation in its substantive definitions and purposes, all as more fully appears from a comparison of 15 USCA s.1262 with Chapter 94B, s.2. Procedurally, the federal model provides specifically that the issuance of regulations shall be undertaken pursuant to the Administrative Procedures found in 21 USCA s.371 (the Food, Drug and Cosmetic Act) and outlines the judicial remedies for review. The Massachusetts statute gives the regulation power to the Commissioner of Public Health (whose responsibilities include Food and Drugs) direct him to conform to federal regulations, and is silent on judicial review.

Under federal procedures, any regulatory action is begun either by a "proposal" made by the Secretary (or interested party upon a showing of reasonable grounds). The Secretary

publishes the proposal and gives all interested an opportunity to be heard orally and in writing. After a thirty-day objection period, the Secretary may then effectively act. However, if within thirty days any person adversely affected by such an order may object, specifying with particularity and request a public hearing, upon such objection, the regulations are stayed. In that event, the Secretary shall give due notice and hold a hearing to receive evidence relevant and material on the issues raised by the objections. Any interested person may be heard. Thereafter, the Secretary shall act thereupon by public order. The order must be based "only on substantial evidence of record at such a hearing" and he "shall set forth detailed findings of fact" on which the order is grounded. (The judicial review which the Federal Act provides is of some interest, since not only may the Court affirm or set aside in whole or in part, temporarily or permanently, the regulation in question; but a petitioner may apply to Court for leave to adduce additional evidence upon a showing that it is material and there were reasonable grounds for failure to earlier produce, and the Court may order the same, the Secretary having power upon such presentment to make findings and/or modifications.)

There is absolutely no question that under the Federal Hazardous Substance Act, where a regulation is proposed which would ban a product and require repurchase, thereby creating retroactive liability and significant manufacturing or marketing impact, the act would "require a notice of hearing, a right of the objecting party to cross-examine witnesses presented by the . . .(Consumer Product Safety). . . Commission, and to present evidence in opposition thereto, and other evidence which may be relevant or material to the issues . . ." Spring Mills, Inc. v. Consumer Product Safety Commission, 434 F. Supp. 416, 431 (1977). In 1977, the Commission banned all self pressurized products containing vinyl chloride by following the administrative procedure in proposing a regulation banning the same. During the thirty-day period for objections, nine comments, including three critical ones, were received. A request for public hearing was denied because the objections were "void of reference to factual information". The case is particularly interesting, since in support of its ban, the Commission had stated "no safe level of human exposure to vinyl chloride has been established", and concluded "the potential hazard . . . is sufficiently serious and immediate to warrant repurchase." The protester sought

judicial review, and the regulating agency agreed that the objections were in effect a nullity and did not necessitate a hearing because the objections were legally insufficient to change the result. The Ninth Circuit reviewed the legislative history at length and concluded that where such a broad grant of power had been given both the original drafters, and subsequently those who had amended the same from time to time, Congress clearly intended that the rigid statutory requirement of a formal hearing should continue in every case where a proposed regulation was controversial and opposed by persons who were adversely affected by the agency's action. Pactra Industries, Inc. v. Consumer Product Safety Commission, 555 F.2d 677 (1977). The rationale of Pactra is applicable here. The Court said that the requirement

> "serves to impose a discipline on the agency's decision-making process, forcing it to present ordered proof to support its position. These procedures permit affected parties to express in a direct and participatory manner their opposition and criticism of governmental action before it becomes final. The public, and the regulated industries, as well as the agency, develop a better understanding of the problem at hand by following these procedures, and the resulting

regulation may be a more refined and precise statement of agency policy. The procedural restrictions imposed on the agency by section 371(e) are admittedly severe, but they are stated with particularity in the rule-making statute, and we can find no reason to dispense with these procedures in this case. If the Commission believes that a substance should not be used where it has been shown to be potentially carcinogenic under intensive exposure conditions, its determination deserves thorough public examination. To implement that determination the agency must therefore follow the procedures Congress has prescribed." Pactra Industries v. CPSC, supra, at 685.

In 1972, Massachusetts completely rewrote the Hazardous Substance Labelling Act by striking out sections one through nine of Chapter 948 and substituting the present version. It is inconceivable that the legislature, in mandating that the Commissioner shall make specific findings of fact regarding the inherent characteristics of a particular product or other specific article offered in commerce was unaware of the fact that the

federal drafters of the model that they were tracking considered public evidentiary hearings on rule proposals which adversely affected interested persons to be an essential procedure to check the broad grant of administrative power.

It is obvious to make such findings about such an article which requires the Commissioner to hold hearings concerned with the particular product. Certainly just such hearings were within the contemplation of the legislature.

21 USCA s. 371 from its initial enactment in 1938 through 1954 and 1956 amendments (making the process less cumbersome) to its present form, mandates a formal

evidentiary hearing whenever a proposal is opposed by persons adversely affected. (See 1968 Duke L.J. 1) The case of Pharmaceutical Manufacturers Association v. Gardner, 381 F.2d 271, was decided five years before the redrafting of the Massachusetts statute.

In the case at bar, the representatives of industry registered their objections to the March 7, 1979 proposal. Since they were interested persons who would have been adversely affected they were entitled to an evidentiary hearing, including the right to cross-examine, and the right to present relevant and material evidence regarding the issues raised by the proposed regulation. They were entitled to such a hearing pursuant to the provisions of Chapter 94B, Section 2.

> "The Commissioner shall cause the regulations promulgated under this chapter to conform insofar as practicable with the regulations established pursuant to the Federal Hazardous Substances Act."

Any claim in this case that the Commissioner may be excused for his failure to conform predicated upon the phrase "insofar as practicable" is doomed to failure on the most fundamental grounds, to wit, factually.[1/] Feasibility is

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1/ Although not in connection with the language of Chapter 94B, Section 2, "insofar as practicable", the Commonwealth, in

(footnote continued)

essentially a question of fact. Here the facts are that such a hearing was clearly feasible. The Commissioner, the Executive Office of Consumer Affairs, and the Attorney General all considered the industry representatives an easily identifiable group of common interest and purpose. The Commissioner thought it practicable to deal industry wide until March 7, 1979. So did the Office of Consumer Affiars. Further, the Attorney General had no difficulty in identifying interested persons when contemplating his Chapter 93A action; and factually, there was an immediate and uniform industry response to this anticipated litigation and the commencement of negotiations and discussions. Simply put, if it is feasible, and it was, to bring a court case against a group of defendants, then that group has sufficient common indicia to be identified for an adjudicative agency proceeding. After all a 94B hearing deals with the examination of some particular product. NAUFIM was the industry's spokesman and the product's advocate.

(footnote continued)

arguing that an adjudicatory hearing under the Administrative Procedure Act is not required, observed as follows: "In order to carry out his statutory duty under the statute, the Commissioner had to consider the interests and concerns of the plaintiffs, other manufacturers, distributors, installers, consumers and even casual visitors to homes, ". . . an obviously large number which it would be impracticable to include in an adjudicatory proceeding." This argument is interesting because it presumes the Commissioner has a policy making discretion to avoid making findings of fact concerning the existence of hazardous characteristics within the particular product being examined and to avoid making the statutory findings as to the particular degree of hazard possessed by that specific product.

B

CHAPTER 30 A REQUIRES AN ADJUDICATORY HEARING

If this court be in error and it is subsequently determined that the provisions of Chapter 94 B, Sec. 2, are not to be construed as this court has done in Part A above, nevertheless I find and rule that the plaintiffs were entitled to an agency adjudicatory proceeding under Chapter 30 A, Sec. 1(1), wherein an agency is mandated to conduct adjudicatory proceedings when "the legal rights, duties, or privileges of specifically named persons are required by constitutional right or by any provision of the General Laws."

First, I find that these adjudicatory proceedings are mandated by a fair reading of Chapter 94 B, Section 2, as applied to the facts of this case. The ban and repurchase regulation at issue seek to impose huge financial liabilities ultimately upon a small select group of manufacturers of a target product. The regulations are not only prospective but are retroactive and impose severe liabilities for past activity which was, at the time done, lawful and proper conduct. The Massachusetts repurchase power copied in essential detail from the federal statute, and the legislature enacted that Section 8 at the same time as it enacted Section 2. It is important to distinguish a Chapter 94 B proceeding from other types of agency hearings. A Chapter 94 B hearing is a proceeding against a thing, an object, or other article of commerce. The issues to be resolved at the hearing all concern the qualities and propensities of that particular res. The act mandates that specific findings by the Commissioner be made on the only relevant issue; to wit, the degree of hazard, if any, the res presents. Therefore, the hearing is not legislative in nature dealing with any policy question; rather the hearing's sole object is to factually determine the attributes of the specific res.

Therefore, it is certainly a reasonable interpretation

of that requirement "conform....insofar as practicable" in Section 2 which meant that when the Commissioner was proposing bans and seeking to invoke the repurchase power of Section 8 that he should afford those interested persons adversely to be affected by the imposition of retroactive liabilities the type of hearing to which they would be entitled under the federal act, and that this statutory phrase "conform...insofar as practicable" therefore is a statutory requirement which is cognizable within the phrase "when required...by any provision of the General Laws... " as those terms are found in Chapter 30 A. Sec. 1(1). Therefore, an adjudicatory hearing is required.

2

Secondly, in any event, I find that Chapter 30 A, Sec. 1(1) necessitates an adjudicatory hearing upon the facts of the cases at bar since these proceedings involve "... the legal rights, duties, or privileges of specifically named persons...". Obviously the proceedings questioned herein involve legal rights and duties. The more difficult question is whether the proceedings were focused upon or directed to "specifically named persons". The argument of the Commonwealth is that the proceedings were of general application throughout the industry. Indeed the line between adjudication and rule making is not always easy to draw. Sometimes it is necessary to examine the interest of the particular parties, to look at the nature of the subject matter sought to be regulated, and to compare the proposed regulation with the statute authorizing its promulgation so as to weigh the relationship, if any, between the regulation and the underlying basic statutory scheme.

To support its contention that adjudicatory hearings were not required, the Commissioner relies upon the six cases discussed below. For the reasons stated, I find reliance upon these cases is misplaced. Cambridge Electric Light Co. v. Department of Public Utilities, 363 Mass. 474, dealt with a

regulation regarding certain billing and collection practices. The regulation was prospective and of general application to all public utility companies. It was issued by the agency who is charged with the overall supervision and regulation of public utility companies, to whom the state has granted certain monopolistic privileges and protections but from which the state has chosen to withhold the right to fix the rates of return on both its investment and equity. For the same reason Massachusetts Electric Company v. Department of Public Utilities, 1981 AS 1277, is not too helpful. Public Utilities are particularly unique statutory creatures and do not share many traits usually found by the profit making entities commonly encountered in America's market place. The regulations in those cases are simply an administrative articulation of that public policy. It is also somewhat easy to brush aside Purity Supreme v. Attorney General and Greenleaf Finance Co. v. Small Loans Regulatory Board, 1979 AS 356. Purity involved a prospective regulation of universal application to the market place issued by the Attorney General to flush out the statutory scheme of public protections and remedies to be afforded to Massachusetts consumers under Chapter 93 A. The regulation set a forward looking standard to be observed by all sellers of all goods and did not adversely affect any significant interest of any particular group. In Greenleaf the parties in that case stipulated that the regulation was not adjudicatory in nature. In any event the regulation was prospective, of general future effect to the permitted maximum rate structure to be used by lenders involved in the business of lending $3000 or less. There is such a long standing well grounded public policy in this Commonwealth regarding small loan interest rates legislatively articulated over the years by both criminal and civil statutes, the relationship between the regulation and the underlying statutory scheme seems basic.

Grocery Manufacturers of America v. Department of Public Health, 1979, AS 2291, is an interesting case but I do not regard it as supportive of the Commissioner's position. Grocery presented a challenge to the open date labeling requirement for certain food products. It was mandated by a regulation promulgated under the authority of Chapter 94. As that case is applicable to this issue, Grocery seems to suggest that one might not be entitled to an adjudicatory hearing in connection with a proposed regulation focused upon requiring all within the food market place to affix certain labels to certain products simply because one might be the subject of a criminal prosecution. Such a possibility is not such a significant interest when prosecution is "unlikely" (see P. 2308) without a prior administrative review and decision which was provided for within the regulation.

Cast Iron Soil Pipe v. Board of State Examiners and Gas Fitters, 1979 AS 2161, 396 NE2d 457, is the most supportive case for the Commissioner's contention that adjudicatory hearings were not required in the instant case. In that case the plaintiff was seeking to protect what it considered a valuable property right, a patented clamp device utilized in connecting hubless sewer or drain pipe installations. The defendant Board is the regulatory Board generally charged under Chapter 142, Section 13, with the making of those regulations which shall constitute the Massachusetts Plumbing Code, and Chapter 142, Section 13, contains no statutory requirement for a hearing. However, as a result of some complaints about the reliability of hubless systems, the Board did hold a public hearing of a "legislative" type. The Board decided to restrict the use of the hubless system to above-ground installations and made that position known. However, before taking dispositive action, the Board held a second hearing but denied Cast Iron's request that this later hearing be adjudicatory in nature. The propriety of that denial was upheld by the Appeals Court. The regulation had a strong and an obvious

relationship with the underlying statutory scheme wherein the Board should adopt uniform reasonable standards based on generally accepted standards of plumbing practice such as promote the public health and safety. The Appeals Court seems to have given the nature of the regulation itself controlling weight in determining that adjudicatory hearings were not required. The standards set by the regulation were of materials by generic type without differentiation among the products of different manufacturers, and Cast Iron, who had the burden of proof on the issue of the regulation's neutrality, did not introduce the underlying standard to which the questioned regulation had reference. The regulation itself was not only strongly related to the basic statutory scheme, it was entirely prospective not to become effective until expected "existing inventories" are depleted. With respect to the question of what "significant interest" Cast Iron asserted, the case presents an obscure picture. The exact nature of the patent was not disclose The plaintiff was not the only cast iron clamp maker. The effect on other manufacturers was not presented. The specific effect upon Cast Iron was not demonstrated.

The consolidated case at bar does not involve an obviously large and indeterminate grouping of interest as did Cast Iron and therefore should not be decided, as Cast Iron was, upon the "functional suitability" concept. (see Cast Iron supra, at p. 2162) The issues addressed by the administrative hearings were two: 1) Does a particular product have such dangerous characteristics as to be such a "hazardous substance" as that term is used in Section 1 of Chapter 94 B that the pet ought to be classified as a "banned hazardous substance". As such the question focuses directly upon the nature and characteristics of the product and its manufacturing formulas, the standards, if any, utilized in its manufacture, storage, handling and shipping, the standards and customs of its distribution, its shelf life, the installation practices and

procedures, licensing feasibility, its labeling and warning suitabilities. Therefore, although broad in scope, the scrutiny is narrow in its application, being limited to a particular item and the inquiry to determine and find the facts regarding its degree of hazard, if any, that the article possesses. 2) Should a specifically named group (UFFI home owners) be granted a right to "repurchase" under Chapter 94 B (constituting a complete removal and restoration) from the targeted group of makers of that particular article[1].

This target group obviously was the wellspring for the entire range of trade practices and uses and other activities which constituted the subject of the inquiry; a source of considerable significance as to the propriety of those practices, and easily a primary source as to the feasibility of those (and other proposed) practices. To argue that it would be neither feasible nor practical to tap that source for the intended inquiry would be ludicrous; and of course the Commissioner does not directly so contend. The thrust of the Commissioner's argument is a more subtle boot-strapping. The Commissioner would cloak the Chapter 94 B hearing fact-finding function with an additional policy making power predicated upon agency expertise and to be exercised in a discretionary manner to implement the statuory scheme of Chpter 94 B. Having so postured the Chapter 94 B hearing, he then argues that the indeterminate public has a right equal to the owners of the questioned res, to be heard on whether this policy making power should be exercised. Therefore, an adjudicatory hearing, given such groupings, would not be feasible.

1/ It was this relatively small group of manufacturers that were singled out. Installers and distributors who might initially be found liable for repurchase were permitted under the regulations to pass on that liability in whole to the makers.

However, I rule that the "functional suitability" test of Cast Iron is not applicable here. This ruling is made because of the nature of a Chapter 94 B hearing and also in reliance upon the findings of fact in part above, that the industry members were an easily identifiable and non-diverse group. The res involved had an obvious spokesman, NAUFIM.

It seems self-evident that the makers of the res have a significant substantial interest that is to be adversely affected by the regulations in question. With respect to the repurchase regulations, it is enough to point to the huge retroactive liability potential imposed therein and the extraordinarily long duration of that imposition. With respect to the ban regulation, it is obvious that when a product is denied access to the market place, the owner-maker directly sustains all of the effects and consequences of that prohibition. In sum, the ~~impact of~~ these regulations upon ~~the~~ makers ~~was~~ direct, total and complete. The effect upon the makers was the primary effect of those regulations.

I conclude that the Massachusetts rule is that where 1) a person has a business property right of significance or possesses a substantial business right; and 2) where that right or interest is at issue or at stake or in jeopardy by a proposed agency action that will both adversely and directly affect such a significant property interest or substantial right; then such interested parties have a right to 1) know and to meet unfavorable evidence of facts regarding their businesses and their business practices and activities. This right includes not only cross-examination and rebuttal offerings but includes the right to offer the agency, affirmative favorable evidence of facts regarding the business and its related activities. This is so because, usually, determinations regarding business and business activities are essentially adjudicatory in nature. It has also been observed

that as persons having such a significant interest, those persons know more about the facts concerning themselves and their activities than anyone else is likely to know. In any event, I conclude that the plaintiffs have the type and kind of interest which required an adjudicatory hearing in Milligan v. Board of Registration in Pharmacy, 348 Mass. 491, 496.

In sum, even if it be decided that Chapter 94 B is silent on the question, having examined the nature of the regulation involved, the type of hearing mandated by the statutory scheme underlying the Hazardous Substance Labeling Act, and applying the same to this case, I find an adjudicatory hearing under Chapter 30 A 1 is required.

3

I find and rule that the principle of statutory construction which favors an interpretation of a questioned statute so as to give it validity avoiding serious constitutional issues is applicable and therefore even if Chapter 94 B is deemed silent on the necessity for an adjudicatory hearing, it is to be implied as mandated by Chapter 30 A.

C

IF THIS COURT ERRED IN RULING THAT ADJUDICATORY HEARINGS ARE REQUESTED, THEN THE DECLARATORY JUDGMENT ACT PROVIDES FOR JUDICIAL REVIEW OF THESE REGULATIONS NOT LIMITED TO THE ADMINISTRATIVE RECORD, AND THE BURDEN OF PROOF TO ESTABLISH THAT THE REGULATION AS FACTUALLY APPLIED TO PLAINTIFFS IS ARBITRARY AND CAPRICIOUS.

1.

First, both the ban and the re-purchase reguation considered together and considered separately and independent of each other constitute a deprivation of a property right accompanied by state action, and I so rule. Ordinarily, therefore, a hearing should precede such a deprivation. Fuentis v. Shevin, 407 U.S. 67, 88. However, where the deprivation is only of property rights, if there is opportunity for ultimate judicial review, then at least in certain instances this does not constitute a denial of procedural due process. Haverhill Manor, Inc. v. Comm. of Public Welfare, 368 Mass. 15, 28.

The Commissioner contends that the administrative hearing given is all that due process requires. Although I have ruled to the contrary, even if I am in error, this is not dispositive of what type of judicial review becomes available to these plaintiffs. The Commissioner contends that the standard of review is narrow and the plaintiffs must show that the regulation is arbitrary or capricious. The Commissioner argues that the regulation is to be sustained unless the plaintiffs can show the absence of any conceivable ground upon which the regulation may be upheld. However the Commissioner goes further and states that the "sole" question here which is dispositive of the plaintiffs' claims is whether

specifically that that particular group constituted "a significant number in and of itself", when the Commissioner made neither a finding as to the number of complaints nor any findings as to the complaint ratio to the number of installations, is an arbitrary finding. Certainly "a majority of nineteen" is very significant if the whole is nineteen, less significant if ninety, discernable if nineteen hundred, miniscule if nineteen thousand. The number of persons suffering adverse health symptoms by itself is only a number; what gives the number its significance is its relationship to the entire group under study. To give a fraction a determining significance independent and irrespective of the quantity of the whole is not reasonable or rational. Perhaps the Commissioner sensed the same when he thereafter found "In all likelihood, substantial numbers of other persons were similarly affected". However, that finding was not footed in fact, but rather was grounded upon an unsupportdd supposition. To proceed to utilize the police power of the Commonwealth by imposing a ban upon a product based upon such supposition is arbitrary and capricious action.

6) That the ban is arbitrary and capricious since there has been no showing that less restrictive alternatives, such as licensing installers or establishing installation standards, would not property effectuate an adequate solution. The failure to conduct a less burdensome remedy was arbitrary.

7) That the repurchase regulations are arbitrary and capricious in requiring an industry member to expend substantial funds without ever affording it an opportunity to question the claimant, cross-examine witnesses, contest causation, or otherwise exercise minimal procedural rights to which it is entitled as a matter of due process of law. They are arbitrary and capricious in the refusal to allow the industry member to determine whether the UFFI at issue is its UFFI or even to allow an industry member

"given the voluminous record ... now filed with this Court and the detailed findings and conclusions...is there any basis to find that the regulations represent a reasonable exercise of the Commissioner's discretionary authority...". That is an inaccurate statement. For purposes of this part, we have assumed that an adjudicatory proceeding was not required. Therefore the "voluminous record" is not a "certified copy of the record of the proceedings under review" as that phrase is used in Chapter 30A, S.14; and that statute is not applicable to the judicial review in this case which is found in Chapter 30A, S. 7 The agency record in this case is a huge gratuitous collection of unsworn written submissions and oral statements and urgings. Indeed, at least with respect to the re-purchase hearings it is not complete.

The plaintiffs attack the regulations under the claim of substantive due process. They seek a declaration of their rights pursuant to Chapter 231A. If the plaintiffs had no constitutional or statutory right to an adjudicatory hearing, certainly to insure a fair and meaningful judicial review, then Chapter 30A, S.7, which makes available a declaratory judgment procedure, is to be construed in a manner which permits the plaintiffs fair and reasonable opportunity to present their claims. In this case the plaintiffs have the burden to go forward at trial and present their proofs. It is incumbent upon the plaintiffs in order to prevail to demonstrate by a fair preponderance of all of the evidence produced to a fact finder that these regulations, or either of them, as applied to the plaintiffs upon the totality of the circumstances found are either unconstitutional or are irrational in their operation.

D.

THE BAN AND REPURCHASE ARE ARBITRARY AND CAPRICIOUS

I find that the plaintiffs have sustained their burden and have established by a fair preponderance of the evidence that the imposition of both the ban and the repurchase regulations are without rational basis in fact.

Specifically I rule, 1) that it was arbitrary and capricious to classify exposure to formaldehyde as an irritant or as toxic at any level of concentration. Consequently the finding that formaldehyde is "hazardous" independent and irrespective of any given level of exposure was, likewise, without a rational basis in fact.

2) That, since the Commissioner was unable to find as a fact the amount of formaldehyde UFFI contributes to the indoor environment and since many other potential sources are present within the ordinary home, the selection of UFFI insulation for separate and different treatment was capricious. As found by the facts above, the many industrial uses of formaldehyde are because of its characteristics as a chemical bonding agent. Urea formaldehyde resins are used in the production of plywood, particle boards and ceiling materials. In any given home, the subflooring, the carpet, its bonding agent, the interior walls, the ceiling, the cabinetry are all urea formaldehyde resin products. These products have the same propensities regarding off-gasing and hydrolysis. Each, any, and all such products may and probably do contribute to the level of formaldehyde concentration found within a home (with or without UFFI insulation). Since the Commissioner did not know the contribution of UFFI insulation to the indoor atmosphere and could not even find whether the indoor atmosphere of a UFFI home had a concentration level equal to or

in excess of a non-UFFI home, the banning of the UFFI insulation was arbitrary.

3) That since the Commissioner could have easily undertaken a comparison study of the ambient levels of UFFI and non-UFFI homes and could have undertaken an epidemiological study and fixed an incident rate for symptoms allegedly caused by UFFI, the promulgation of the regulations without such knowledge was arbitrary and capricious. Even if this Court's ruling on the necessity for such adjudicatory hearings is deemed to be in error, certainly for an agency to promulgate administrative regulations rooted in ignorance, leaving the important issues of causal connection and contribution and incident rates unanswered and, indeed, even unexplored, is to perform its agency function in an irresponsible and totally arbitrary manner.

4) That the Commissioner's finding that UFFI creates an appreciable risk of harm to a significant number of persons was a finding not based upon any rational basis. The evidence established and I conclude that it is highly unlikely that any individual will experience any "substantial personal injury or substantial illness" as that phrase is used in Chapter 94B, Sec. 1, the proximate cause of which is an exposure to an unacceptable level of formaldehyde caused by a properly installed Tripolymer installation. Likewise, since the evidence warrants, I find for the Formaldehyde Institute and Borden in that there is no rational basis upon which one may conclude that it is likely that significant numbers of persons will experience such a "substantial" injury or illness as the proximate result of formaldehyde exposure from UFFI insulation when it is properly installed.

5) That the agency finding that UFFI either "caused or significantly contributed" to certain adverse health symptoms experienced by the majority of nineteen consumers, and more

to verify the existence of UFFI in the building at issue.

8) The repurchase regulations are arbitrary and capricious in requiring an industry member to repurchase UFFI as a result of the existence of certain health symptoms while precluding the introduction of any evidence tending to show that the symptoms in question are not caused by UFFI or formaldehyde while prohibiting the introduction of evidence on causation and not requiring any finding by the administrative reviewer that those symptoms are caused by UFFI.

9) The repurchase regulations are arbitrary and capricious in requiring an industry member to repurchase UFFI as a result of an occupant's having experienced one health symptom on one occasion only since the installation of UFFI and never having experienced that symptom again, and in denying the industry member any opportunity to be heard upon that issue.

10) A finding for Borden and the Institute is required because the repurchase regulations are arbitrary and capricious in precluding the introduction of any evidence as to the formaldehyde level in the indoor or outdoor ambient air and in failing to condition "repurchase" on a showing that there is any formaldehyde inside the home. In precluding the introduction of any evidence as to the presence of other sources of formaldehyde, and particularly by excluding the introduction of any evidence as to the presence of any indoor air pollutants, the regulations are arbitrary and capricious.

11) The repurchase regulations are arbitrary and capricious in imposing an improper burden of proof upon the industry member because they obligate the referee to find that the statements of the individual claimant are true unless the record "clearly and convincingly demonstrates that...(those allegations)...are untrue".

12) A finding for Borden and the Institute is required because the repurchase regulations do not provide for any actual and meaningful adjudicatory rights before a "Certificate of Right to Repurchase" is issued.

E.

THERE ARE SEVERAL ISSUES OF LAW THAT HAVE NOT BEEN PREVIOUSLY ADDRESSED BUT WHICH SHOULD BRIEFLY BE DISCUSSED:

1.

Are the repurchase regulations repugnant to constitutional due process? The answer is hedged. If the plaintiffs have a right to an adjudicatory hearing before the product is banned, the agency has considered the issue of hazard. Many of the questions that plaintiff might seek to raise in a repurchase hearing would have previously been considered. The Hazardous Substance Labeling Act repurchase concept never contemplated a cumbersome, individual, repetitive, adversary proceeding. If one looks only at the repurchase regulations and from the view that no prior adjudicatory hearing is to be had, then the regulations are certainly suspect. The fundamental point is simply that the plaintiffs cannot be denied access to all forums. If, as was attempted herein, the plaintiffs are not allowed to meaningfully contest the Commissioner's proposed finding of hazardous, and then are silenced at the repurchase hearing on the theory that the issue of hazard has been decided, due process has been abused. However, in this case the plaintiffs have now had a judicial review (even if it is held they are not entitled to a prior adjudicatory hearing) in which they have had a full opportunity to present proofs and confront the evidence offered against them. Deferral is not always denial and is sometimes permitted. Consequently, the issue need not be further examined.

2.

Are the repurchase regulations in conflict with Section 8 of the Hazardous Substance Act? Once again, the facts as found and the rulings made herein have diminished the importance of this issue. However, it should be stated that the remedy of repurchase set forth in the regulation does not exceed its statutory basis. Simply put,

the legislature entrusted the implementation of its policy to the agency; and this agency had the power to fashion a repurchase scheme This court's rulings are that although such a repurchase plan would be authorized by law, in this case there should have been a prior adjudicatory hearing; or, if deemed an administrative regulation, that it lacks a rational basis.

However, the ruling should be carefully stated since, if upon appellate review, it is determined that neither a prior adjudicatory hearing, is necessary and that this administrative regulation does have a rational basis, then such a referee-type tribunal as created hereunder would be extremely troublesome. This is not because of Chapter 94B. I reject the contentions of the plaintiff that Chapter 94B limits the purchaser to pursue solely his installer or limits the amount of recovery to the purchase price. The scheme would be troublesome for two reasons, the first being the constitutional due process considerations mentioned immediately above. If this referee-tribunal created by these regulations is to be construed as an adjudicatory body, it is important to note the heavy burden of proof that is upon those who would avoid liability, and that all issues of causation are barred. No hearings are to be held, no questions asked, no evidence taken. Second, Chapter 94B does not authorize the Commissioner to create such an adjudicatory tribunal. It is only if the referee review is considered as a reasonable administrative appendage of stated policy implementation (the parties having had previously opportunity to contest that policy) that such a repurchase scheme is to be considered as properly authorized.

3.

The pre-emption claims raised have no application to any of the cases at bar. Suffice to state there is no basis for the contention that federal law has pre-empted the field plowed by Chapter 94B. Certainly there is no irreconcilable conflict, and the Commonwealth's assertion of power is plainly within the scope of its police power. There is nothing within the Commerce Clause which aids the plaintiffs. The issue is so clear no

extended discussion would be helpful.

4.

The Anderson foam case has been brought as a class action on behalf of all urea-formaldehyde foam insulation contractors or installers. There are approximately one hundred fifty contractors who have made retail sales of UFFI to be used by residents and who are adversely affected by the repurchase regulation. However, certification of the class has never been actively sought, and in light of the findings of fact and rulings made herein, it does not seem prudent to act upon the question of certification at this juncture.

5.

The motion for Summary Judgement on behalf of the Commissioner previously taken under advisement is now to be endorsed "Denied for reasons set forth in a memorandum filed this date".

Conclusion

Obviously individual homeowners who seek compensatory damages from manufacturers, distributors and installers are uneffected by this case. Those private remedies for breach of an implied warranty of fitness or merchantability and or for negligent manufacture or installation remain fully available to those who have been aggrieved by either such negligence or breach of warranty.

The scope of the present ruling is limited solely to the issue presented and should not be misconstrued as creating any obstacle to any homeowner seeking relief from either a negligent installation or from unfit insulation product.

Simply put this court rules that before the Commissioner can ban all future use of UFFI insulation, he must hold an adjudicatory hearing. (And in the alternative, if the legislative type hearing was sufficient, then there does not exist in the evidence presented at trial a sufficient basis which would warrant the conclusions which the Commissioner reached). Nothing contained herein prevents the Commissioner from undertaking such an adjudicatory hearing.

Order for Judgment

The prevailing parties are to prepare a suggested form of judgment. All parties shall be heard on that issue on Friday, January 29, 1982 11:30 A.M. Suffolk Motion Session.

John T. Ronan

John T. Ronan
Justice of the Superior Court

Entered:

SUMMARY OF THE EVIDENCE AND FINDINGS AND CONCLUSIONS CONCERNING FORMALDEHYDE AND UFFI

SUMMARY OF THE EVIDENCE AND FINDINGS AND CONCLUSIONS CONCERNING FORMALDEHYDE AND UFFI

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SUMMARY OF THE EVIDENCE AND FINDINGS AND CONCLUSIONS CONCERNING FORMALDEHYDE AND UFFI

I. Introduction:

This summary reviews the extensive evidence presented by interested people pursuant to the March, 1979 public hearings concerning urea-formaldehyde foam insulation (UFFI). It also provides certain findings and conclusions. In order to provide an overview of the contents of the summary, this introduction will consist of an annotated outline of each of the topics reviewed in the summary itself in the order in which they appear:

I. Introduction.

II. Chemical Composition of UFFI.

This section provides a brief background on the chemical components of UFFI and how those components are installed in consumers' homes.

III. Description of Health Problems Experienced by UFFI Consumers.

Subsection A of this section reviews testimony of Massachusetts home-dwellers who had UFFI installed in their homes. This testimony has been summarized so as to focus upon the symptoms and other information reported which relates to the installation of UFFI.

The Commonwealth's involvement in issues concerning the possible health dangers posed by UFFI stems from consumer complaints similar to those which are reported in this subsection. This subsection appears near the beginning of this review in order to provide the context in which the Commonwealth took an interest in UFFI and to provide perspective for this summary.

Subsection B briefly summarizes reports from scientists and others which relate to adverse health effects experienced by people in other states who also had UFFI installed in their homes or who suffered other forms of formaldehyde exposure. Certain of these reports are recounted in more detail in section V.

Subsection C draws conclusions concerning the reported symptoms.

IV. The Emission of Formaldehyde from UFFI.

Subsection A of this section states the reasons why formaldehyde may be released from UFFI.

Subsection B looks at the available scientific tests showing whether formaldehyde is released from UFFI and, if so, how much is released.

Subsection C draws conclusions concerning formaldehyde emissions from UFFI.

V. Health Effects of Formaldehyde.

This section reviews the available evidence concerning health symptoms associated with formaldehyde exposure. It is subdivided as follows:

A. Animal studies.

B. Workplace studies and occupational standards.

C. Clinical and epidemiological studies.

D. Specific health effects on children.

E. Expert opinions concerning the irritating, sensitizing and toxic properties of formaldehyde.

F. Expert opinions and regulatory standards concerning safe levels of formaldehyde vapor in homes.

G. Conclusion.

VI. Causation.

Subsection A discusses whether UFFI is a cause of adverse health effects. This subsection draws upon material presented in prior parts of this review insofar as it shows whether there is a link between UFFI and adverse health effects.

Subsection B discusses opponents' arguments concerning whether UFFI causes health injury.

Subsection C proposes conclusions concerning whether UFFI causes adverse health effects.

VII. Characterization of the Frequency of Adverse Health Effects Due to UFFI.

In order to determine the frequency with which UFFI adversely affects people, a comparison between the number of homes with UFFI and the number of people experiencing health symptoms must be made. Therefore, subsection A of this section reviews the available information concerning the number of people whose health is adversely affected, while subsection B looks at the available information concerning the number of UFFI installations in Massachusetts.

Subsection C proposes conclusions concerning frequency of occurrence of health effects.

VIII. Alternatives to a Ban.

This section considers whether the danger posed by UFFI can be averted by anything short of a ban.

Subsection A discusses remedies proposed by the industry for dealing with individual UFFI problems.

Subsection B looks at whether licensing installers will eliminate the formaldehyde problem.

Subsection C considers whether UFFI can be adequately labelled to protect the public health.

IX. Economic Impact of a Ban.

The opponents of the proposed ban have argued that the economic impact of a ban should be taken into account. The economic arguments put forward by opponents are revieved in subsection A of this section.

Subsection B looks at the economic impact of keeping UFFI on the market.

Subsection C proposes conclusions concerning these economic considerations.

X. Imminent Danger.

This section states the factual foundation upon which a finding that UFFI presents an imminent danger is based.

XI. Findings and Declarations Concerning Formaldehyde and UFFI.

This section states findings and declarations concerning formaldehyde and UFFI pursuant to M.G.L. c.94B.

II. Chemical Composition of UFFI

The industry reports that urea-formaldehyde foams were first developed in Europe in 1933 and that Northern European countries have used these foams extensively as insulating materials since the early 1960's. Interest in this country blossomed only with recent fuel shortages. Review of available data reveals that the vast majority of installations in Massachusetts occurred after 1976.

Urea-formaldehyde foam insulation is produced by the installer from component chemicals at the consumer's home at the time of installation. This on-site production is one of its unique features.

The insulation is made of three basic ingredients:

(1) urea-formaldehyde resin;

(2) a surfactant (generally called a foaming agent or catalyst); and

(3) air.

The resin and foaming agent are usually transported to the site separately in liquid form, although the resin is also available as a powder which the installer must dilute with water.

The resin is made of urea, a solid at room temperature, and formaldehyde, a gas at room temperature. The foaming agent contains an acid catalyst which causes a series of complicated chemical reactions when combined with the resin.

Exact chemical formulations of UFFI remain trade secrets. CPSC reports that minor components are often added to the basic formulations to improve or alter the foam's properties. For example, additives, fillers, extenders and plasticizers may be added to mask odor, to reduce brittleness or to discourage vermin (Opponents' Exhibit 9(r); see also Dr. Lepow, O. Ex. 111).

To install UFFI, the installer uses a compressed air pump and a mixing or foaming gun. The foaming agent is generally pumped into the gun where compressed air expands it into a foam consisting of tiny air cells. The urea-formaldehyde resin is pumped into the gun nozzle through a separate line. The foam bubbles are coated with the resin as they pass under pressure through the gun nozzle. The resin-coated foam is then emitted from the gun nozzle as a white lather with a shaving cream consistency, containing 75% water by weight. As soon as the resin mixes with the foaming agent on the surface of the foam bubbles, the soft foam begins to form the final UFF product, a rigid material consisting of resin-coated foam surrounding countless numbers of microscopic air spaces. This hardening process is called "curing" and is usually completed within a few days to a few weeks. The rate of curing depends on a number of factors, including temperature, humidity, and foam formulation.[1]

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[1] Most of the information reported here is taken from "NBS Technical Note 946, Urea-Formaldehyde Based Foam Insulation: An Assessment of their Properties and Performance," as reported in Opponents' Exhibit 9(r).

III DESCRIPTION OF HEALTH PROBLEMS EXPERIENCED BY UFFI CONSUMERS.

This section reviews testimony of Massachusetts home-dwellers and reports from other states concerning health problems in UFFI homes. Subsection A reviews Massachusetts home-dweller testimony. Subsection B reviews symptoms reported in other states. Subsection C draws conclusions based on this evidence.

A. Testimony of Massachusetts Home-dwellers.

1. McGlew Family (T. 121 et seq.; P. Ex. 38).

The McGlews testified that they had lived in their home for 12 years prior to the installation of UFFI. Their home was insulated in early February, 1978.

Beginnng in March, 1978 their eleven year old daughter experienced tiredness, swollen glands, and hayfever symptoms. Robert McGlew felt eye irritation and his wife, Marjorie, felt extreme weakness, swollen glands, inability to articulate thoughts, vertigo, depression, and, by the end of May, abdominal pain and loss of internal sensations. Five doctors whom she saw during this period were unable to diagnose her condition.

On June 16 she collapsed unable to move, saying she was dying. She was pale and cold to the touch and her breathing was very shallow. She was rushed to the hospital by ambulance where she improved each day for the week that she stayed.

Dr. James O'Shea, her physician, diagnosed her condition as "anaphylaxis secondary to the fumes of urea formaldehyde foam ...and strongly recommended that they not go back into the home."

After she left the hospital their home had a strong odor and on humid days just a few minutes inside would bring on eye and throat irritation.

The McGlews moved out of the home after this episode, but moved back into the house in mid-October 1978. Marjorie was extremely sensitive to automobile exhaust and cigarette smoke after she was hospitalized.

An insurance adjuster representing the UFFI manufacturer visited the home in August, 1978 and became quite uncomfortable after a few minutes in the house. He left, commenting that something certainly was wrong.

On November 1, Robert returned home to find Marjorie in bed experiencing the same weakness she had had in the spring. They moved out that evening.

Others who have visited the house, including the McGlews' daughter-in-law, have experienced the rapid onset of eye and throat irritation. As of the date of the public hearing the odor was still strong in the kitchen and bathroom, although the house was aired using an exhaust fan not long before.

The McGlew home has had a gas stove, gas hot water heater and gas dryer over the 12 years they have owned it. They did not experience symptoms similar to the ones described above until the installation of UFFI.

After installation of UFFI they laid a rug approximately 8 foot by eleven foot. They did not add any particle board to a room they renovated.

2. St. Pierre Family (T. 157 et seq.).

The St. Pierres moved into their house in September 1977. They reported their health as excellent, neither having any respiratory problems. Their house was insulated with UFFI in walls and in both attics in March 1978.

They noticed the odor the first night and for several days thereafter. The installer recommended that they air the house. The odor became worse. They experienced tearing eyes and a burning sensation in the nose and throat. Barbara St. Pierre, who was pregnant, also reported feeling nauseous. Friends and relatives could not stay inside for any length of time when they dropped by.

The St. Pierres report being healthy since moving out of their house. Once a week one of the family members returns home to get the mail. On these short visits they find that the odor is reduced during cold weather and returns when the weather is warm.

3. Duddy Family (T. 10 et seq.; P. Exs. 51(b)-(c)).

The Duddys report that they had no problems with their home prior to the insulation of their exterior walls with UFFI in August 1977. They noticed a strong odor and experienced nausea, a burning sensation in the eyes, raspy and sore throats, headache and a funny taste in their mouths. The strong odor lasted through September. Although it subsided in the winter, it returned on humid or hot days, when the sun heated a certain side of their house, or on windy days. Beginning in March, the odor and symptoms returned.

When he attempted to seal cracks where the drafts and fumes enter, Charles Duddy became high and dizzy and got a headache.

The family reported that the odor was especially bad in the kitchen when they were cooking and eating meals. Some visitors commented on the odor.

4. Owsiak Family (T. 89 et seq.).

Winifred Owsiak told the UFFI installer that both she and her mother had lung problems (emphysema, asthma) and were sensitive to odors. Her mother was doing well, and Winifred Oswiak testified that she did not want to endanger her health She asked twice if there would be any health hazards; the installer said that there might be an odor for the first 24 hours but no health problems thereafter.

The Owsiaks had their home insulated with UFFI in the walls and attic on June 10, 1977. The installer mentioned having compressor trouble. For the next two weeks the odor was persistent, especially on hot and humid, damp days. Ms. Owsiak had her mother move out.

In the spring both she and her mother experienced headaches but felt some relief when the windows were opened. Her mother felt "tight upon arising, with burning and pussing of eyes, dry nose, mouth and throat."

Following the June 20, 1978 air sample by DPH, Winifred Owsiak was advised that both she and her mother should move out of the house.

On July 14, 1978 foam was removed from the attic, but not from the rest of the house. On July 20, during a heat wave, her mother woke up feeling "extremely weak and tired with eyes burning and pussing, mouth and throat dry, difficulty in breathing and headache from odor." She also felt a headache and sick feeling, dry mouth and throat, "puffy sensations of the face and eyes. . .bad sensations of a nose bleed, . . .prickling around lips, . . .chest and throat tightness."

When the windows were closed at the end of September her mother's condition worsened severely, causing them to move out. Her mother was "wheezing very badly, had great difficulty in breathing" and had "dried up so bad that I really didn't think. . .she would pull through." The doctor advised them to move out and the ill effects described above disappeared.

Winifred Owsiak reported that visitors all complained about their eyes burning and about the smell. When she returns to check on the house it "is so dry that. . .your tongue actually sticks to your mouth."

5. Kelly Family (T. 2-66 et seq.; P. Exs. 20, 45, 48, 49, 50).

The Kellys had their newly built house insulated with UFFI in mid-December 1977. Early in May they moved into the house, 2 weeks before their baby was born. Paula and Fred Kelly both immediately experienced eye irritation and dry mucous in the nose

Friends and relatives who visited noticed the odors. Paula Kelly reported that the odors were particularly noticeable upon entering the house but that her body adjusted after being indoors a while.

Early in the fall Paula Kelly saw an ear specialist because of discomfort and irritation. He diagnosed her condition as allergic rhinitis due to an allergy to a chemical. He advised nasal irrigation and hot showers.

In the fall they were forced to close the windows in their baby's room. The next day the child "was not his usual self" and did not want to eat. He started vomiting and turned pale. He vomited again and, after a 15 minute sleep, awoke having dry heaves until he vomited bile.

His doctor told Paula Kelly to bring him right in. When they arrived he had vomited bile about six time, his eyes were rolling, and he was very pale and in a deep sleep from which she could not rouse him.

The doctor admitted him to the hospital and ran numerous tests. Within 12 to 18 hours he improved considerably. His skin had been very dry at home. After two days in the hospital it improved. A patch test to 2% formaldehyde solution was positive. The doctor advised they not take him back home. His condition was diagnosed as possible formaldehyde poisoning.

The UFFI was removed in October 1978; the Kellys report no problems since the foam was removed.

6. Pereira Family. (T. 2-79 et seq.; P. Exs. 44(a)-(c), 46, 47).

The Pereiras testified that their house was insulated with UFFI before the interior walls were installed. They report that prior to the installation the house had been fine. After the installation of the foam, the Pereiras experienced severe irritation of the eyes and nose. The fumes came in waves or clouds without any warning after they moved in. Sometimes their eyes burned so badly in their bedroom that they were forced to sleep downstairs on the sofa. Their two year old son continually rubbed his eyes. Every morning they awoke with dry, irritated throats even though they had a central humidifier.

After the Kelly baby became sick, the industry finally agreed to remove the foam from the Kellys' and Pereiras' homes. The Pereiras report that their symptoms have since subsided but that their son's eyes are still affected.

They left home for days and had no problems duri. , that time. The first three days after they returned their twelve year had a nose bleed each day.

After the attic insulation was removed the "heaviness" in the air was gone but they still had medical problems. In March 1979 the pediatrician said their children's coughs were an allergic reaction to the insulation and suggested that the children stay elsewhere for a while.

8. Cornwell Family (T. 2-59 et seq.).

Aaron Cronwell had UFFI installed on the first and second floors on the two windward sides of His Rockport house in the fall of 1977.

Since the installation, Cornwell's wife and son have experienced constant odor, headaches, sore throats with a harsh burning sensation, ear infections, and difficulty in swallowing. Their inflamed throats have been verified by doctors. Their son's bedroom and playroom were insulated. The son had constant congestion, colds and was once diagnosed as having a small pneumonia infection. After he was removed to the third floor on the south side of the house, he has had no more problems

The only other change the family made in the 200 year old house was remodelling of the kitchen. They removed the foam from the kitchen when the walls were taken down. The builder complained of sinus problems at the time.

Mr. Cornwell has blocked off the insulated portion of his home with polyurethane sheets and closed doors. When one of these doors is opened, the fumes can be detected instantly.

People outside the family have commented on the odor.

9. Barth Family (T. 23 et seq.; P. Exs. 52, 52(a) - (c)).

The Barths reported having UFFI installed in the house they were building in October 1977. Donald Barth experienced no problem when working on the house before the UFFI was installed. Mr. Barth had suffered a mild case of asthma in the past. Since moving to the Cape, he had stopped taking asthma medication because the air was clean. He told the UFFI salesperson of his asthma and was assured that the insulation is non-toxic.

7. Smith Family (T. 2-45 et seq.).

The Smiths report that they smoke and have gas heat and a gas stove, but that they never had any odor or formaldehyde problem until after their Framingham home was insulated with UFFI. They had the attic floor insulated in October, 1977 and the walls done in April, 1978.

Since the foam was installed they have had to sleep with the windows open every night. Visitors continually comment that their eyes sting and throats hurt, especially on humid days. The gas man said what he smelled was not gas.

All the Smiths have had sore throats, nausea, congestion and colds, stinging eyes, difficulty breathing, headaches, dry throats, weakness, dizziness, and phlegm coughed up each day. The children have had frequent and severe nose bleeds and numerous upper respiratory infections, including bronchitis and ear infections. One family member has received medication for nausea; they have all seen doctors and been given medication for sore throats, congestion, and colds.

In December 1977 Richard Smith's voice became scratchy and gravelly. In January, when both adults went to a doctor for sore, red throats, Richard Smith's biopsy was borderline. He was sent for monthly checkups with an ear, nose and throat surgeon. The specialist found his throat very red but otherwise fine medically.

Two weeks after the foam was installed in the walls in April, 1978, their six year old son started having at least two nose bleeds each week that lasted 1-2 hours. He has been sent home from school nine times and has missed 49 out of 129 school days. The family has paid over $400 for tutors to keep him at his grade level.

In July, their son was hospitalized for two days for a four hour nose bleed that was beyond control. The allergist said he was sensitized to formaldehyde from their UFF and suggested they move or keep him away from it.

Mr. Barth's father-in-law, a carpenter, worked on the house for two or three hours a day, putting on casings to seal the house. While working he developed the first of three "nose bleed(s) that you (could)n't believe," requiring that his nose be packed at the hospital. The third time he was hospitalized for three days.

Barth himself had a nose bleed and "an eye that looked like a piece of liver." He also suffered a sore throat. At the hospital he was told that he had infected sinuses and that something must be bothering him badly.

After the UFFI was installed, workpeople sometimes delayed work because the fumes were so strong.

These symptoms were experienced several months before rugs particle board were placed in the home.

Nine months after the foaming, the Barths moved into the house. They were unable to stand it for more than three weeks. Both Donald Barth and his wife experienced chest pains. Mr. Barth could not sleep and Maryann, his wife, was nauseous. Their doctor advised them to move out. Maryann developed a rash on her face and terrible laryngitis, which is a problem for her as she is a teacher. Mr. Barth went back on his asthma medication.

Their oldest daugther has become so sensitized to formaldehyde that she cannot dissect at school. The youngest daughter, who had never before experienced bronchial problems, has had bronchitis three times.

In August, 1978, a DPH inspector could not stay in the house while he was testing.

In January 1979 the foam was removed but the odor problem persists. The odor problem is worst in hot and humid weather.

10. Andersen Family (T. 2-101 et seq.; P. Exs. 22-24).

The Andersens installed UFFI in their home in September, 1977. On the first day that foaming began, Veronica Andersen experienced a sudden difficulty in breathing and sneezing. From October to March after the foam was installed, the Andersons continued to perceive a strong odor, often causing them to leave the home for 2 or 3 days at a time.

In the past 18 months since the foam was installed, the family has suffered the onset of adverse health symptoms never experienced before. William Andersen has had frequent discharges of blood from his nose, a rash on his face, and trouble with dry skin, although previously his skin was oily. He also had two extremely severe nose bleeds and for two weeks suffered heavy yellow mucous which would crust one eye shut. In discussing this eye symptom with an eye surgeon, the doctor indicated that some of Mr. Andersens symptoms could very well relate to formaldehyde.

The family's oldest daughter got nose bleeds at night. The younger daughter has "dryer skin than you'd think normal for a seven year old" and a regularly stuffed up nose.

Veronica Andersen has a past history of allergies (hayfever, allergy to animal fur). She has experienced difficulty breathing, a chronic cough, constant dryness in the throat and stuffed up nose since the home was insulated. Dr. D. T. Harrington, her physician, reported on March 22, 1979 that her pulmonary function tests shows mild airway obstruction and that she has subacute bronchitis as a result of the foam.

The family has spent about 2 of the last 18 months away from their home and must now remove the foam at their own expense.

11. Boyer Family (P. Ex. 37).

Mr. Boyer had his house of 32 years insulated with UFFI in February 1978.

About two weeks later he "became ill with symptoms of severe head cold or flu," which his physician tried to treat with cough medicine and antibiotic. The severe cough, nasal and eye irritations, and headaches continued for weeks after. When windows were open in the summer the symptoms appeared to go away. The family noticed "foul odors. . .that were compared to a dead animal or burning styrofoam cup."

In the fall Mr. Boyer's symptoms returned, accompanied by stomach pains and leg cramps. By January the symptoms were so bad they went to Florida for a month. The symptoms subsided shortly after arrival in Florida but reappeared "as bad if not worse" when they returned home.

Mr. Boyer has abandoned his house and his symptoms have subsided.

11. Cole Family (T. 2-133 et seq.).

The Coles insulated their house with UFFI in October, 1977. Prior to the installation they reported having no problems. They have made no other changes in their house since installing UFFI.

Since the foam was put in all family members have had eye irritation, ear irritation, nose bleeds, and upper respiratory problems. The Cole's son has had two ruptured ear drums from an abscessed ear. At four months of age he had to be put in an oxygen tent in the hospital because of bronchial problems.

When the family went to Florida in February all their symptoms disappeared, only to reappear the morning after they returned.

12. Rowley Family (T. 2-142 et seq.).

Hunter Rowley had UFFI installed in a bedroom which he added on to an existing home. For ten days to two weeks, upon "entering that room there would be a distinct irritation, smarting of the eyes, and. . .coughing." The plumber did not want to work at that end of the house for about 10 days because he could not remain in the room more than 10 minutes.

After the room was painted, the fumes subsided substantially. Mr. Rowley is now pleased that he insulated his home with UFFI.

13. Leger Family (T. 2-35 et seq.).

The Legers had UFFI installed in mid-November, 1977 in the interior walls of a newly constructed Westminister house. Before installation there was no unusual odor. Even though the house was still open, after installation the house had a strong smell.

On January third, after the walls were put in on the first floor, Donald Leger moved in with his pregnant wife and twelve month old son. The odor was still present and "would cause a burning sensation in (his) eyes and nose and throat. . .as soon as (he) came into the house."

He and his wife had colds, stuffed up heads, headaches, difficulty sleeping, and breathing problems. When the house was closed up, Ms. Leger had nose bleeds. Donald Leger can only sleep by taking nose drops and antihistamines.

Three weeks after moving into the house, the twelve month old son was admitted to the hospital for two days with bronchitis. When he came home he was unable to shake off the cold symptoms. On February 6, 1978, the day of the great blizzard, he was hospitalized with meningitis. He was taken to Children's Hospital where his condition was diagnosed and where he recouperated for twelve days. He left the hospital doing fairly well, but two days later got worse. He had a series of six ear infections.

The installer agreed to remove the exposed foam. The contractor wore no protective head gear when he began removing the foam; he had to go home, complaining of "the worst cold he ever had in his life." After that workers wore respirators. They removed about 70% of the foam.

The smell has gone down significantly. The odor in the house is the same odor that family members smelled from the exposed foam, only less intense. Both visitors to the home and family members still noticed the odor as of March, 1979, especially on damp days or when water was boiling on their electric stove.

14. Heinz Family (T. 138 et seq.).

Warner Heinz had UFF insulation installed in the outside walls and the floor of the den of his East Bellerica home on cold day in November, 1977. Promptly thereafter family members noticed a pungent smell, especially as the weather got colder and wetter. The fumes were unpleasant even when the windows were opened. Windows had to remain open throughout the house the entire winter. That odor has never gone away.

Even with a large, powerful exhaust fan running 24 hours a day in the den and the windows open, the family experienced headaches, congestion, nose bleeds, cough, respiratory problems, eye irritations, and laryngitis. Ms. Heinz had migraines, dizziness, vomiting, nausea, drowsiness and occasional skin irritations on her arms and face. Mr. Heinz had chest pains and trouble sleeping.

They have seen three doctors and have incurred large medical bills. After trying different antibiotics unsuccessfully, Ms. Heinz' doctor "realized that the problems that she had were totally. . .from an outside irritation." Doctors have warned them to get out of the house.

Warner Heinz reports that his overall condition has deteriorated; this has caused a decline in his work performance.

The family has developed allergies to soap, perfumes, cologne, after shave lotion, detergents, and printer's ink.

In September Heinz had the foam removed from the den floor, which was also the garage ceiling. At first he thought the problem had disappeared, but it

returned "with a vengeance" when the weather got hot. It was also bad on cold, wet days.

15. Ryan Family (T. 148 et seq.).

The Ryans reported living in their home of 30 years prior to having UFFI installed. The installer had trouble blowing the UFFI into the home because the temperature was so cold that the foam froze in the pipe.

They noticed the odor right away and awoke the next two days with headaches. The second morning they got a show of blood when they blew their noses and Mr. Ryan's eyes were crusted shut.

Ms. Ryan's allergy problem had been dormant for several years. Mr. Ryan had asked the installer whether her old allergies would be affected by the foam. He was assured the insulation would not harm his wife. By the fourth day all Ms. Ryan's allergies had returned. Her doctor recommended that she leave the house after he learned about the newly installed UFFI. She went to visit her son for two weeks. Two days after she returned her problems came back. She had to move out again.

The Ryans have been forced to sleep in a 14 foot trailer. They eat dinner in the house and have tried several times to sleep overnight but "it just doesn't work."

16. Gaberman Family (P. Ex. 40).

The Gabermans report having UFFI installed in the walls and cathedral ceilings of their house on an unspecified date.

Family and friends began noticing a severe smell and severe eye irritation problems during the early summer months of 1976, particularly during very warm weather. The industry finally agreed that the foam was unsuitable for cathedral ceilings and agreed to remove all the foam from the ceilings and replace it with suitable insulation. No further problems were reported.

17. Farmer Family (T. 42 et seq.; P. Exs. 15(a) - (c), 16, 91).

The Farmer family had lived in their home for 30 years before insulating the exterior walls with UFFI on December 30, 1974. A tenant had occupied the second floor for 22 years.

Immediately after installation of UFFI, the tenant found the fumes sickening and unbearable and remained away as much as possible, maintaining that she was unable to live in the house. She visited the hospital at least twice with red, puffy eyes. Her heart doctor and her eye doctor both told her to move out.

Between 1974 and 1977 the Farmers made no changes in their home. Late in the summer or early in the fall of 1977 they first noticed an odor which came and went, smelling like damp plaster or burned wood; sometimes they noticed a chemical smell.

The odor had caused drowsiness and eye and throat irritations, headaches, nausea, heartburn, a burning sensation in the chest, and difficulty in breathing. Ed Farmer experienced all these symptoms and his wife suffered most of them. During the winter there were times when the fumes became so irritating that Mr. Farmer drove his car with the window down until the burning in his eyes, throat, and chest stopped.

The fumes became so unbearable, even with the windows wide open all year, that the family moved into the uninsulated portions of the house. First they moved their bedroom to the uninsulated ell of the house; then they moved to the main cellar, and then to the cellar under the ell. When that did not work, they moved out to a twenty foot camper in the driveway, where they lived at great inconvenience.

Henry Baron, the city gas inspector, testified that he attempted to take certain air readings in the Farmers' home, having turned off their gas a few weeks earlier. Upon entering the house he felt himself getting violently sick and "thought (he) was going to collapse right in (the Farmer's) dining room." He managed to get out to his car and drive no more than a hundred feet around

the corner to his house. His vision was distorted and he felt terrible pressure in his head between the eyes. Getting home "was one of the hardest things that (he) ever had to do in (his) life." He made it to the divan inside his house and stayed there almost three hours. He told Mr. Farmer that he could not return to his house anymore.

18. Brewster Family (T. 2-28 et seq.; P. Exs. 58, 58(a) - (c)).

The Brewsters had the exterior walls of their house insulated with UFFI in December 1977. They made no other changes in their home at the time. The house contains a gas range and gas heat.

Ms. Brewster felt the onset of problems in May, 1978 when she and her children started breaking out in acne. Although one child was a teenager, the other child was only age 10 and Ms. Brewster was long was past the usual age for acne.

The immediate family experienced numerous other medical symptoms: respiratory difficulties, nausea, memory loss, sneezing attacks, coughing because of excess phlegm, headaches, dizziness, chills, aching ribs from the constant cough, mucous in the stools, lethergy, sore throats and nostrils, much depression, and changes in appetite and sense of smell. The family had experienced coughs and sniffles before this, but never like those suffered after UFFI was installed.

A letter from Ruthann E. Holferty-Diggs stated that she and her husband visited the Brewster home for 4 days during the summer of 1978, and that they both felt nausea and dizziness that abated only when they left.

Ms. Brewster reported a definite correlation between the time spent inside her house and her illness. She saw her doctor after being sick May 12-25. He was sure she had pneumonia until he saw her X-ray. Upon learning that her house had UFF he "felt the condition probably resulted from the formaldehyde fumes." The children were sent away every weekend and over the summer.

19. Butler Family (P. Exs. 56, 56(a) - (c), 56 (e)).

The Butlers had their home insulated with UFFI on an unspecified date. They reported that intensely irritating, noxious formaldehyde odors first appeared in August, 1978. The foaming of the child's bedroom "resulted in a medically directed evacuation of the home."

19. Doyle Family (P. Ex. 53).

The Doyles had UFFI installed in their home on an unspecified date. Installing this insulation in the exterior walls was the only change they have made in their Worcester home in the last ten years.

The Doyles wrote that their children have had constant upper respiratory illnesses "just about continually from October through April" in the two years since UFF was installed in their house. Their older child, Kelly, age 5, could not breathe through her extremely congested nose. Her eyes itched on and off, making her uncomfortable and irritable. Kelly has missed 21 days of school.

The Doyles also reported numerous problems prior to the installation, including ear and throat problems.

The family has smelled no odor since the first week after UFFI installation.

b. Reports of Health Problems by Non-Consumers.

Professor Peter A. Breysse, Associate Professor Director of Industrial Hygiene and Safety, Univisity of Washington, investigated 39 cases in which people in the Seattle area complained after having their homes insulated with UFFI. Professor Breysse reported that the most common symptoms found were irritation of the eyes, nose and respiratory tract, chronic headache, chronic nausea, and chronic drowsiness, sometimes described as memory lapse. Other symptoms found were nasal congestion, bronchial asthma and difficulty in breathing. T. 102, 103, 105.

Carl Zenz, M.D. and Mary Ann Woodbury, M.C.H. of the Wisconsin Department of Health and Social Services reported a number of similar symptoms of formaldehyde exposure in 34 dwellings (27 mobile and conventional homes with chipboard, 6 conventional homes with foam, 1 conventional home with both chipboard and foam), including eye irritation, tearing, sore throat, cough, awakening with headaches, change in taste of food, and a physician report of behavioral changes. Symptoms in infants less than 6 months of age included vomiting, diarrhea, watery eyes, restlessness, excessive crying, refusing food other than mother's milk. Symptoms of infants whose mothers were exposed before birth have included generalized dermatitis and apnea. In each infant case, a pattern was noted of severe vomiting and diarrhea while in the home for a period of time. P. Ex. 32, pp. 1-3.

Mary Ann Woodbury stated that health symptoms of formaldehyde-related illness were reported in Wisconsin between January 1, 1978 and January 25, 1979 in 56 homes involving 107 people. Of the 62 people for whom health histories were available, she stated that the following symptoms were reported:

Symptom	% of People Reporting
eye irritation	69%
upper respiratory irritation (cough, sore throat or runny nose)	53%
respiratory difficulty (shortness of breath or tightness of chest)	26%
headache	25%
fatigue	20%
vomiting	9%
diarrhea	10%

Twenty-one percent reported existing health conditions such as asthma, chronic lung disease, cardiovascular disease, or allergies. Thirty percent of the people age 17 and older indicated they are smokers (in the U.S., 32.2% of the same age population smokes).

Six of eleven infants of less than 24 months of age required hospitalization; three were hospitalized for gastrointestinal problems (vomiting, and/or diarrhea), and three were hospitalized for respiratory problems (rales, tachypnea, apnea, respiratory distress symptoms). In each case the symptoms decreased or stopped when the infant was removed from the home and returned when the infant was returned to the home.

In all of the infant cases of acute health problems during exposure to formaldehyde vapor in the home, whether in mobile homes, new conventional homes, or homes with UFFI, a consistent and similar pattern of illnesses has been seen. In all of the cases seen, the health problems have disappeared after removal of the infants to alternate residences. P. Ex. 42.

Mary Ann Woodbury also reports that the Minnesota Health Department has made similar findings. Of twenty-one infants surveyed in Minnesota, the two outstanding problems are respiratory difficulties and diarrhea or vomiting or both. As in Wisconsin, these patterns tend to disappear for children above the age of 2. P. Ex. 42, p. 5.

The U.S. Consumer Product Safety Commission in its "Summary of In-Depth Investigations Urea Formaldehyde Foam Home Insulation", "Summary of Newspaper Clippings, Consumer Complaints and State Reports Urea Formaldehyde Foam Home Insulation", and "Summary of Incidents Investigated by the Connecticut State Health Department Urea Formaldehyde Foam Home Insulation" reports the following health symptoms commonly reported by UFFI home-dwellers: eye irritation, lower and upper respiratory irritation, headaches, skin rash, vomiting, and diarrhea, among others. The Connecticut summary included 44 cases. P. Exs. 1, 2, 3.

C. Conclusions Concerning Reported Symptoms.

Consumer experience has shown great similarity in reported symptoms. Respiratory irritation, difficulty in breathing, nausea, tiredness, nosebleeds, headaches, dry skin, eye irritation and dizziness were commonly experienced chronic symptoms. In the great majority of cases, most or all of the family members were affected, more than fifty family members all together. Additionally, there were complaints by non-family members such as visiting friends and workpeople. Children frequently displayed these symptoms, and were frequently more severely affected than were adults.

The onset of most symptoms followed closely on the installation of UFFI in the homes of those testifying. A few of the complaints have no apparent relationship to the installation of UFFI (e.g., the Legers' son's meningitis) or are of dubious origin (e.g., pregnant Barbara St. Pierre's report that she became nauseous after the installation of UFFI). Some people first experienced symptoms several months after the installation of UFFI. This latter occurrence appears consistent with the fact that some people noted seasonal fluctuations in the presence or severity of symptoms; many noted fluctuations dependent upon temperature and humidity conditions.

The association of the onset of symptoms with the installation of UFFI is highly suggestive of a causal relationship between the presence of UFFI and the reported symptoms. This relationship is further suggested by the fact that removal of UFFI from households resulted in the disappearance, or significant abatement, of the reported symptoms. The symptoms routinely subsided when the home, or the insulated portion of the home, was temporarily vacated; symptoms returned when the home was again inhabited. Similarly, upon abandonment of the home, symptoms disappeared. Each of these facts is evidence of this causal connection.

Reports from scientists with experience in this area in other states corroborate the information reported by Massachusetts consumers. Professor Breysse, Ms. Woodbury and Dr. Zenz describe eye irritation, upper and lower respiratory irritation, nausea, and headaches among the symptoms reported by UFFI consumers in other states. The reports of the Consumer Product Safety Commission are also consistent with these reports. Ms. Woodbury's summaries of the Wisconsin experience also indicate that infants are especially severely affected.

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When these symptoms first appeared in a substantial number of Massachusetts home-dwellings after insulation with UFFI, many people believed that the symptoms were related to exposure to formaldehyde,[2] one of the major component ingredients in UFFI. The Department of Public Health proposed to ban UFFI because of the formaldehyde it bears and emits into the air of insulated homes. The bulk of the scientific testimony at the public hearing centered on whether UFFI emits formaldehyde and, if so, whether the formaldehyde emitted accounts for the adverse health effects experienced by UFFI consumers.

Sections III, IV and V of this review will discuss these issues. Section III will discuss whether UFFI emits formaldehyde into the homes in which it is installed and, if so, how much. Section IV describes health effects known to be induced by formaldehyde exposure. Section V then considers whether the health symptoms experienced by Massachusetts UFFI consumers are characteristic of formaldehyde exposure, and, if so, whether the symptoms were caused by the formaldehyde emitted from UFFI.

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[2] Throughout this review of the evidence, the word "formaldehyde" will refer to formaldehyde in vapor form.

17. THE EMISSION OF FORMALDEHYDE FROM UFFI

This section will review the available material concerning formaldehyde emissions from UFFI as follows:

A. Explanations of the Release of Formaldehyde by UFFI.

B. Scientific Tests Reflecting Formaldehyde Release from UFFI.

(1) Laboratory Tests on Samples of UFFI.

(2) Ambient Air Tests Showing Formaldehyde Levels in Homes Insulated with UFFI.

C. Conclusions.

A. Explanations of the release of formaldehyde by UFFI.

Experts for both proponents and opponents described formaldehyde release as a characteristic of UFFI under certain conditions.[3] Several theories explaining this release are discussed below.

1. Release due to heat or humidity.

Most experts cited high temperature or humidity a cause of vapor release.

Dr. Lepow stated that the chemical reactions involved in formation of UFFI are reversible under some temperature and moisture conditions, thereby causing vapor release. O. Ex. 47.

The National Bureau of Standards and the Formaldehyde Institute both describe this process as hydrolysis and note that it may occur under conditions of high temperature and humidity. O. Exs. 9(c), 7.

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[3] We do not consider here formaldehyde release during the "curing" process. The "curing" process is ordinarily short relative to the life of the foam, and may cause formaldehyde vapor to be emitted for a few hours or up to a few weeks after installation. A "surge" of formaldehyde as high as 8 ppm may occur after installation according to P. Ex. 94. Other evidence did not quantify the amount of vapor released during curing, but emphasized the short duration of the curing process.

Professor Breysse testified that he has taken air samples every 2 hours in some homes. His results showed that the formaldehyde concentration rose as the temperature increased. When the temperature fell, the formaldehyde level decreased as well. T. 115.

William H. Snyder, Professor of Chemistry at the New Jersey Institute of Technology, stated in a letter to the New Jersey Department of Energy that Tripolymer Foam contains almost 30% combined formaldehyde by weight, which can be released to the surroundings by reaction of the polymer with atmospheric moisture conditions over long periods of time. P. Ex. 73.

Thomas J. Smith, Ph.D., Assistant Professor of Industrial Hygiene at the Harvard School of Public Health, wrote to Paula Kelly that "formaldehyde concentrations may be higher when the relative humidity is elevated (e.g. raining)." P. Ex. 50.

Bruce Christopher, Chief Executive Officer and 100% stockholder of Celcius Insulation Resources, reported in a March 6, 1979 deposition that three of the four UFFI manufacturers tested by the National Bureau of Standards "had what is termed a hydrolysis problem. High temperature and humidity had a tendency to break [the UFFI] down [in attics]." P. Ex. 85 at p. 35. Mr. Christopher believes that Celcius' urea-formaldehyde foam may nonetheless be used in attics because Celcius employs a plasticizer to eliminate any hydrolysis problem. High humidity, however, will lengthen the curing process even with Celcius foam, resulting in odor over a longer period of time. P. Ex. 85 at 35 et seq.

According to a Consumer Product Safety Commission report, a Special Epidemiologist from the New Jersey Health Department expressed concern that warmer, humid weather would increase formaldehyde concentrations in UFFI homes by very significant amounts. P. Ex. 84 at p. 7.

Other evidence agreed that high temperature and/or humidity will increase formaldehyde release from UFFI. See e.g., P. Ex. 60(b); P. Ex. 24.

2. Vapor release because of the chemical composition of UFFI.

Dr. Firstman of Science Applications, Inc., suggested that UFFI will release formaldehyde because of the chemical composition of the foam. The emission occurs "as the long chain polymers will change their form," a process he described as accelerated by high temperature and humidity. T. 275-6.

Professor Peter Breysse also cited that weak chemical bond between urea and formaldehyde, concluding that some formaldehyde emission is a necessary correlary of foam installation. Dr. Breysse believes that there is enough experimental evidence to indicate that UFFI will continue to give off free formaldehyde theoretically until the foam is completely disintegrated. T. 113-114.

3. Faulty installation as a cause of vapor release.

Another factor often cited as a contributor to formaldehyde release is faulty installation or manufacture. This factor is discussed in section VII (B) of this review.

B. Scientific tests showing formaldehyde release from UFFI.

Tests of two varieties have been submitted documenting the formaldehyde emission properties of UFFI: (1) Laboratory tests on foam samples; and (2) ambient air tests showing the amount of formaldehyde in homes insulated by UFFI.

Laboratory tests are conducted by taking a piece of UFFI foam, placing it in a temperature-controlled setting, collecting the air surrounding it and testing that air for formaldehyde content. While laboratory sample tests do not show how much formaldehyde may be present in the air of a home insulated with UFFI, they do show whether the foam emits any formaldehyde at all. Tests conducted over long periods of time show whether the foam continues to emit vapor as it ages. Laboratory tests can also be conducted on foam subject to high temperature or humidity conditions.

Ambient air tests, on the other hand, show the amount of formaldehyde present in the air in homes insulated with UFFI. While these tests are more directly relevant to our inquiry, the available tests do not control the many variables that may affect the presence of formaldehyde in the home. For example, as discussed above, temperature and humidity may affect the formaldehyde levels detectible on any given day. A test conducted on a cool, dry day may provide misleading information as to whether UFFI emits formaldehyde into homes in hot or humid weather. A second weakness of these tests is their inability to provide unassailable proof that the formaldehyde detected in fact issued from UFFI and was not caused by or contributed to by other potential sources of formaldehyde in the home.

A discussion of the laboratory and ambient air tests submitted follows:

(1) Laboratory tests showing formaldehyde release from UFFI.

a. Bowser-Morner Test on Aerolite Foam (O. Ex. 29)

This test on Aerolite foam was conducted using the chromotropic acid test (C.A.T.), the testing method most well-established for measuring formaldehyde content in air. This test resulted in a single formaldehyde vapor reading of .16 ppm.

b. Breysse Test (T. 113-114)

Professor Breysse cited a test on foam up to 2-1/2 years old taken from homes in which no problems were reported. Formaldehyde vapor was found still present 72 hours after the foam was placed in a bell jar in a laboratory. T. 113. The actual test method and results were not submitted. We do not know how much formaldehyde was emitted from the foam.

c. Connecticut State Tests (P. Ex. 41)

The Connecticut state tests used a different testing method, called a Drager Tube analysis, and therefore cannot be directly compared with the Aerolite results. This method is not as accurate as C.A.T., but does test

specifically for formaldehyde. The Drager analysis permits measurements no smaller than .5 ppm and no greater than 10 ppm, and will tend to err as much as 20-25% in comparison with equivalent C.A.T. results. This study was more extensive than the equivalent Aerolite test.

The formaldehyde released from seven different brands of UFFI was measured periodically to reflect emissions over time at room temperature. These test findings showed that almost all of the foam samples continued to emit vapor up to 56 days. The results reported revealed:

No. of Days	Average Amount of Formaldehyde Emitted from 7 Brands of Foam[4]
1 to 5	8.5 ppm (25 samples)
6 - 10	6.5 ppm (22 samples)
11 - 15	5.4 ppm (15 samples)
16 - 20	10 ppm (3 samples)
20 - 25	10 ppm (1 sample)
56	10 ppm (2 samples)

One brand of UFFI was described as "new 'low formaldehyde' foam." It was tested after 3 days, 7 days, 10 days and 22 days; each reading was greater than 10 ppm.

These results show greater levels of formaldehyde emission than revealed by the single Bowser-Morner test on Aerolite. Although these results are unreliable as exact measures of the amount of formaldenyde emitted due to the inaccuracy of the Drager Tube as a measure of vapor levels, these tests do show that emission may continue over time even at room temperature.

The Connecticut laboratories also conducted a series of tests on heated foam samples. The resultant formaldehyde readings ranged from 1 ppm to 10 ppm. All samples continued to emit formaldehyde up to 20 days. Although the number of samples tested was limited and does not provide a broad enough base for reaching any conclusion concerning the effects of temperature on UFFI, these tests do again provide evidence of formaldehyde emission from the foam over a period of weeks.

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[4] Many of the results were listed as larger than 10 ppm. These were treated as 10 ppm for the purpose of these averages.

(2) Ambient air tests showing formaldehyde levels in homes insulated with UFFI.

Opponents have submitted three studies of ambient air levels inside homes: a Louisiana test by Borden, Inc., (O. Ex. 140); tests by CIBA-GEIGY (O. Ex. 49)[5]; and a formaldehyde out-gassing test by Dr. Firestman (O. Exs. 14-16). For the proponents, we have evidence showing the formaldehyde vapor levels in homes of UFFI consumers tested under state auspices in Massachusetts, Connecticut and Washington.

a. Louisiana Study (O. Ex. 140)

The Louisiana study relied upon by Borden, Inc. was conducted in a single home over a period of approximately one month. Although offered as evidence of the overall emission properties of Borden's foam, this test appears to demonstrate the amount of formaldehyde emitted during the curing process.[6] UFFI was installed in the walls of an existing home on March 29, 1977; the home was tested for formaldehyde vapor on March 29, 30 and 31. The results show scant formaldehyde emissions in most rooms immediately after installation. The maximum formaldehyde levels reported were .007 ppm in the living room, 1.4 ppm "air condition condensate" and 2 ppm at a crack in the west wall.

The test did not purport to determine formaldehyde emission over the life of the insulation.

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[5] Opponents' Exhibit #122 also reported tests conducted by CIBA-GEIGY in the United Kingdom, without appending copies of test results. None of these tests specifically measured formaldehyde emission.

Opponents' Exhibit #123 includes results of formaldehyde vapor tests in 18 homes insulated with UFFI by New England Aerolite. The study was not completed. Almost all 18 reported less than .5 ppm according to the exhibit.

[6] The study submitted described a series of tests in one home over 4 days. O. Ex. 140. Dr. Cummin testified that the formaldehyde levels in the same home were tested one month later (T. 2-247), but did not submit any documentation reflecting that test result.

b. CIBA-GEIGY Tests (O. Ex. 49)

CIBA-GEIGY conducted tests on cured foam under constant temperature and humidity conditions. The temperatures and humidities to which the foam was subjected were intended to approximate the most severe conditions experienced in UFFI homes. These tests showed that 13 days of aging at 158°F and 100% relative humidity produced only trace amounts of formaldehyde.[7]

c. Firstman tests (O. Exs. 14-16)

Dr. Firstman submitted exhibits entitled "Formaldehyde Concentration Data Winter" and "Formaldehyde Concentration Data Summer" describing a number of homes in the northeast which he considered representative of homes with "normal [UFFI] insulation experience with varying ages of foam." His tests were not intended to investigate extreme cases, but rather average houses with normal insulation experience. Because more than a few homeowners denied access to their homes for measurement purposes, Dr. Firstman believes the tests do not reflect a true random sample. O. Exs. 14-16.

The winter chart lists fifteen homes in New York state, eleven insulated with UFFI and four homes without foam insulation. The chart states the level of formaldehyde concentration in parts per million (ppm) both outside the home and in various rooms inside the home. Opponents Exhibit 16 states that the winter data was obtained during cold weather months of January and February, 1978, when "houses in the Northeast are closed to minimize heat losses."

The summer chart lists twelve (12) homes located in New York, each insulated with UFFI. The chart lists the formaldehyde concentration in ppms both outside the house and in three (3) rooms in each house. Opponents Exhibit 15 states the houses in which the formaldehyde concentration was measured were generally open.

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[7] This test was part of a series. The other tests conducted did not measure the amount of formaldehyde vapor emitted, concentrating on other signs of decomposition. O. Ex. 49.

windows were open, providing ventilation of the house interior. The exhibit states that this is in contrast to the winter conditions described in the winter data table.

Dr. Firestman concludes from his winter chart that the background concentration of formaldehyde ranges from 0 to .03 ppm. He finds that UF foam adds 0 to .04 ppm. He states that cooking with natural gas contributes .01 to .05 ppm and a fireplace or a woodburning stove contributes .01 to .05 ppm.

Dr. Firestman states that the primary sources of formaldehyde in residential atmosphere based on this summer chart are the outside atmosphere and kitchen gas range. He states that UFFI adds .00 to .01 ppm.

Dr. Firestman also includes a "Summary of Field Data" in Exhibit 14, which concludes that UFFI that is "well formulated, properly applied, current technology" results in formaldehyde contribution of 0 to .01 ppm in good ventilation and 0 to .04 ppm in poor ventilation.

These tests reflect a small sampling of "normal" UFFI homes. They indicate that there was some formaldehyde present in these homes. The data base does not, however, adequately support any finding as to the precise formaldehyde contribution of each item (e.g., UFFI, gas ranges, woodstoves) to the total formaldehyde level.

d. Massachusetts tests

State agents in Massachusetts tested formaldehyde levels in homes at the homeowner's request. The results of the tests do not constitute a scientific study of formaldehyde levels, and purport only to reflect a systematic listing of the formaldehyde readings requested.

Two separate sets of tests were done by state laboratories in Massachusetts. The first series tested all aldehydes present in the homes (called a "total aldehyde" test (T.A.)). T.A. tests were conducted on 73 homes. Of these, 26% revealed less than .1 ppm aldehydes; 50% showed .1 to 1.0 ppm; and 22% showed 1.0 to 2.9 ppm aldehydes.

The T.A. test does not isolate formaldehyde, so it is not necessarily a reliable indicator of formaldehyde emissions from UFFI. See, generally, discussion of T.A. tests at O. Ex. 9(a)(2), pps 83-86; O. Ex. 9(u), p. 85.

The Massachusetts state laboratories also ran a series of tests using the chromotropic acid test (C.A.T.). One hundred ninety-eight (198) tests were conducted using this method. Some homes were also tested by industry representatives. These homes are not randomly representative; again they reflect a pool of concerned or troubled UFFI consumers who initiated contact with state officials.

According to a summary prepared by the Executive Office of Consumer Affairs the C.A.T. tests done by state personnel show:

Formaldehyde Level (ppm's)	No. of Homes	% of Sample
0.0	42	21%
Trace - .02	68	34%
.03 - .09	46	23%
.1 - .47	42	21%
TOTAL	198	99%

P. Ex. 87

In some instances we were provided with industry test results to supplement state test results. The McGlew home, for example, was tested by the state in June, 1978 on a hot, humid day, showing formaldehyde at .4 ppm. NAUFIM measured .071 ppm and .225 in February, 1979 when the humidity was 47%, and the temperature 35°-42°F. We cannot compare and assess these different test results, however, as the testing conditions were not controlled (for example, the weather conditions were not necessarily similar on the days of the two different tests).

e. Washington tests (P. Ex. 17)

In Washington, an uncontrolled sampling of UFFI homes was tested by the Department of Environmental Health. A total of 39 homes were tested, representing only those people reporting symptoms or other reasons for concern about UFFI. The tests results showed:

Formaldehyde Level (ppm's)	No. of Homes	% of Sample
.1	25	27%
.1 - .49	49	53%
.5 - .99	6	6%
1.0	13	14%
TOTAL	93	100%

f. Connecticut tests (P. Ex. 3)

State agents in Connecticut conducted tests using a Drager Tube analysis. These results therefore cannot be directly compared with results in the other states. The test results showed:

Formaldehyde Level (ppm's)	No. of Homes	% of Sample
.5	21	50%
.5 - 1.0	11	26%
1.1 - 2.0	6	14%
2.0 - 4.0	3	7%
7	1	2%
TOTAL	42	99%

C. Conclusions concerning Formaldehyde Emissions from UFFI.

The laboratory tests described above demonstrate that UFFI emits formaldehyde. Expert opinion indicates that the extent of this release is affected by temperature and humidity conditions.

The ambient air tests do not provide a foundation for concluding precisely how much formaldehyde will be found in UFFI homes on account of vapor emissions from UFF insulation. Ambient air tests showed formaldehyde readings from 0.0 ppm to 1.0 ppm using the preferred C.A.T. test method in Massachusetts, Washington and New York. Figures ranged from .5 ppm to 7 ppm using the less accurate Drager tube analysis in Connecticut.

We lack tests controlling other factors that affect the vapor emission properties of the foam, such as temperature and humidity conditions, portion of the home insulated, installation technique, etc. We also lack tests isolating UFFI-caused vapor from vapor present due to other sources of formaldehyde in the home.

Overall, the evidence submitted indicates that UFFI releases formaldehyde. The amount of formaldehyde vapor that this emission may cause in ambient air in UFFI homes depends on a number of factors and is not quantifiable based on the evidence available.

V. Health Effects of Formaldehyde Exposure

This discussion will review briefly the available evidence reflecting the health symptoms associated with formaldehyde exposure in the following order:

A. Animal studies.

B. Workplace studies and occupational standards.

C. Clinical and epidemiological studies.

D. Specific health effects on children.

E. Expert opinions concerning the irritating, sensitizing and toxic properties of formaldehyde.

F. Expert opinions and regulatory standards concerning safe levels of formaldehyde vapor in homes.

G. Conclusion.

A. Animal Studies.

Animal studies constitute the bulk of the available evidence reflecting adverse health effects associated with inhalation of formaldehyde vapors. The effects induced in small mammals (rabbits, rats, mice, dogs, cats) range from irritation and inflammation of the respiratory tract to convulsions and death, depending on the dose, the duration of the exposure and the species of animal among other factors. The most common observations include evidence of lacrimation and respiration difficulty. The evidence supports the conclusion that the extent of injury is directly related to dose and exposure duration.

The fact that formaldehyde vapors are injurious finds support in almost all of these studies. Adverse health effects have been induced in animals at exposure levels ranging from .05 ppm to 7830 ppm. Exposure durations have ranged from a few minutes to 90 days. The mammals so exposed have exhibited symptoms that are now commonly associated with formaldehyde vapor exposure: respiratory

interference, irritation, lacrimation; high doses result in vomiting, cramping and death. See P. Ex. 63(e) at p. 517 and O. Ex. 9(a) at pp. 156 et. seq. for charts showing symptoms experienced by mammals in formaldehyde vapor tests.

The abatement of symptoms once exposure ceases is another characteristic of formaldehyde exposure revealed in animal tests. See, e.g., T. 228.

More controversial hypotheses describe how or why the vapor has these detrimental effects. See, e.g. P. Ex. 63(e) and P. Ex. 42; compare T. 2-306 to 307.

None of the animal studies address the precise question facing us, however, because none involved long term exposure to formaldehyde gas. The longest time period over which animals have been continuously exposed is just 90 days. The 90-day test was commissioned by the U.S. Navy and conducted in 1969. Five species of mammals were exposed to air-borne formaldehyde at 3.8 ppm for 90 days in order to determine appropriate air standards for Navy submarine personnel. O. Ex. 141. One of the rats died. None of the other animals showed any signs of illness or toxicity according to the study authors. Hematologic values were normal. On histopathologic exam, the lungs of all species showed varying degrees of interstitial inflammation. The hearts and kidneys of guinea pigs and rats showed local chronic inflammatory changes. The study's authors were uncertain whether these changes were caused by formaldehyde inhalation, and considered that, in spite of these findings, "most parameters were essentially normal" in the study subjects. The report concluded, "however, the death of 1/15 of the rats indicates the need for additional studies."

Although opponents have cited this study as proof that formaldehyde is non-toxic over 90 day exposure (O. Ex. 138), the study authors were unwilling to draw that conclusion, finding rather that the single test they conducted for formaldehyde provided an insufficient basis for a confined space guideline.

The government agency setting Navy submarine standards based on that study reduced the 90 day formaldehyde limit to .5 ppm, less than 1/7 the tested level, apparently without further comment. O. Ex. 142.

One of the studies submitted by Drs. Kane and Alarie included two series of tests designed to measure the effect of repeated daily exposure. P. Ex. 63(e). The first series exposed the mice to 3.1 ppm for three hours each day for four consecutive days in order to determine whether the mice became sensitive or tolerant to the gas. Tests results revealed that the maximum effect on the respiratory rate increased each day when the mice were exposed over 4 consecutive days.

A second type of repeated exposure involve pre-exposing the mice to a concentration of .31 ppm for 3 hours per day for 3 days, and then measuring the respiratory rate decrease on the fourth day after a single ten-minute exposure at higher concentrations. Results showed that the pre-exposed mice did not react differently than control specimens to the single, higher exposure on the fourth day.

These results suggest that repeated exposure to 3 ppm or more may cause increasingly severe symptoms; .31 ppm or less may avoid an increasingly serious response in the very short term. These results remain merely suggestive of the long term effect of repeated daily exposure, however.

Wells Laboratories, Inc., an independent testing laboratory, has conducted a series of animal tests on UFFI at the request of Borden, using a test method for "toxicity" and "irritancy" set out in federal regulations under the Federal Hazardous Substances Act (16 C.F.R. s.1500.3(c)(1) and (2) and s. 1500.41-42). O. Ex. 143. The toxicity tests exposed rats to UFFI foaming agent and reagent in mist form; the rats also inhaled fresh and cured samples of UFFI, pulverized and administered as a dust. These substances proved non-toxic according to the particular test (a substance is toxic under this test standard if half or more of the rats die within fourteen days).

The irritancy tests showed that UFFI foaming agent and fresh and cured samples of UFFI were all non-irritating according to the test standard. The UFFI reagent produced minimal irritation on abraded skin only.

These studies did not test the toxicity or irritancy of formaldehyde.

We lack animal tests on formaldehyde using the precise federal toxicity or irritancy protocol. It is clear that these particular animal test methods and standards are not mandated under the federal regulations. Further the tests are of limited usefulness with respect to formaldehyde and UFFI. The animal test for inhalation of toxic substances under these standards involves exposure to 201 to 20,000 parts per million by volume of gas or vapor, but only if such concentration is likely to be encountered when the substance is used in any reasonably forseeable manner. As formaldehyde is not likely to be encountered in such concentrations, even if these tests were used to measure the effect of formaldehyde vapor on rats, they would not be relevant.

Experts for both proponents and opponents agreed that there is a very serious need for testing of the long-term effects of formaldehyde vapor. Witnesses at the public hearing used such words as "desperate" and "urgent" to describe the need for these studies.

The animal evidence nonetheless provides documentation of the adverse influence of formaldehyde vapor on living tissue. Drs. Alarie and Kane believe, based on the available information, that measurements of respiratory rate decrease in animals appear to be reliable in predicting that an airborne chemical will evoke sensory irritation in humans. P. Ex. 63(c) and 63(e). On the whole, other evidence received does not contradict this opinion. Compare O. Ex. 109.

3. Workplace Studies and Occupational Standards.

A number of workplace studies were reported in the documents and testimony proferred by both opponents and proponents. (see, e.g., O. Ex. 9(a)(2); O. Ex. 9(t); O. Ex. 9(u); T. 281 et seq; P. Ex. 63(e); T. 516; O. Ex. 109).

These studies revealed complaints of irritation and other adverse physical effects from formaldehyde vapors at particular concentrations. Significant decreases in the function of small airways of the lung over the course of a given workday have been reported. T. 73. Workers have experienced annoying odor, constant prickling irritation of mucous membranes, thirst, heavy tearing, and disturbed sleep over an 8 hour day. P. Ex. 18 (also included in O. Ex. 9(o)).

Tearing and irritation of eyes, nose and throat are commonly reported. The menstrual and reproductive functions of women have also been implicated. For a review of available occupational studies, see O. Ex. 9(u) at pp. 128 et seq., O. Ex. 109 and Chart #2, appended at page 62 of this summary.

Chart #2 correlates the symptoms reported by workers with the formaldehyde concentrations to which they were exposed. Characteristic symptoms of formaldehyde exposure have been reported at levels as low as .13 - .45 ppm, although we do not know how many workers reported these symptoms or whether these workers were also exposed to other noxious gases as well. Symptoms are reported on exposure over a range from .13 to 3 ppm.

Dr. Craigen, a medical practitioner in England and Divisional Medical Officer at CIBA-GEIGY, Ltd. testified that he is in the process of conducting a retrospective survey of the past health records of CIBA-GEIGY workers exposed to formaldehyde and comparing them to data taken from a survey of the consultation rates of 1,000 people in the general population. Describing his results to date, Dr. Craigen stated that there is no "particularly striking pattern of diseases when compared with the figures seen in the general population, apart from the expected increase in contact dermatitis and increased incidence of nosebleeds." T. 288. The difference in number of nosebleeds appears to be statistically significant according to Dr. Craigen. T. 291. Although exact figures are not available, Dr. Craigen estimates that the workers surveyed were exposed to greater than 5 ppm formaldehyde. The average formaldehyde level today in CIBA-GEIGY plants is 2.35 ppm.

The chart submitted by Dr. Craigen outlining his survey results shows a dramatic difference between the exposed workers and the general population in pleurisy, pneumonia and pneumonectomy, although Dr. Craigen does not mention this difference in his testimony. See O. Ex. 17. In total, a number of potentially very serious health conditions appear in the health records of

exposed workers that do not appear in the general population files. The survey is not yet complete.

These studies have provided the basis for recommendations and requirements limiting occupational exposure to formaldehyde gas. The most oft-cited workplace standards include one mandated by Occupational Health and Safety (OSHA) regulations (29 C.F.R. s.1910.1000, subpart Z) and the somewhat lower level recommended by the National Institute for Occupational Safety and Health (NIOSH) (O. Ex. 9(a)(2)). Opponents argue that these standards reflect findings that formaldehyde vapor is safe at the particular levels of exposure permitted in the workplace.

The OSHA standard requires that formaldehyde exposure not exceed 3 ppm as an 8-hour time weighted average in any 8-hour work shift over a 40 hour week. An employee may be exposed to 5-10 ppm for no more than 30 minutes, but only if that exposure is compensated by exposure less than 3 ppm to arrive at a 3 ppm average. No employee may be subjected to concentrations in excess of 10 ppm.

By contrast, NIOSH recommends no more than 1 ppm during any 30 minute period for people who work up to a 10 hour day for a 40 hour week over a working lifetime. Increased monitoring and medical surveillance of employees must occur once measured levels exceed .5 ppm. NIOSH relied on numerous studies reflecting irritation, even pulmonary edema and death from massive doses.

The trend in workplace standards appears to reflect increasing cautiousness about formaldehyde-induced injury. At one time the threshold limit value (TLV)[8] was as high as 5 ppm (O. Ex. 9(c)); reports of irritation and other health injury contributed to the lowering of the TLV. P. Ex. 63(e). The NIOSH

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[8] According to Drs. Kane and Alarie, the goal of a TLV is to define conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. P. Ex. 63(e) at p. 516.

recommendation represents a greater concern about health effects than the less recently promulgated OSHA standard. The Soviet standard today reportedly limits occupational exposure to .1 ppm. (P. Ex. 60(b)).

Some of the workplace standards cannot be readily interpreted. Although spacecraft and submarines present similarly tight confined spaces, for example, the U.S. Navy limits 90 day continuous exposure to .5 ppm (O. Ex. 142), while the manned spacecraft level is not permitted to exceed .1 ppm over the same length of time. (P. Ex. 89).

The consensus of the evidence comports with common sense in dismissing occupational standards as measures of safety for home environments. Experts note that the two settings present dramatically different circumstances: Workplace exposure is limited to the length of the work week, while exposure in the home may occur up to 24 hours, 7 days. Workers who react to formaldehyde vapor are either discouraged from entering workplaces while the vapor is present, or are likely to leave the employment; home occupants would not have these options. Workers are generally healthy and able-bodied, while home occupants may be ill, very young or very old. Workers may be exposed to other chemicals in addition to formaldehyde, while home occupants would not. Unlike homes, workplaces can be equipped with cautionary signs, protective gear, emergency procedures and medical personnel.

An elaborate critique of the limits of the workplace TLV was presented by Drs. Alarie and Kane, long-time students of the effects of airborne contaminants like formaldehyde. Alarie and Kane speculate that the TLV of 2 ppm for workers is based on the reactions of people who have become de-sensitized to the presence of formaldehyde, an accomodation pattern the scientists observed in their mice within a few minutes of each vapor exposure. Dr. Alarie believes that some workers will accomodate, while others will not; only those who do will remain on the job.

P. Ex. 63(e). Experts for the opponents have also described an accomodation pattern as characteristic of formaldehyde exposure (see, e.g., T. 2-226), and have further noted that symptoms abate in humans when contact with the chemical ceases. See, e.g., T. 2-264 to 265.

Bodies like NIOSH specifically caution that "this standard was not designated for the population at large and any extrapolation beyond the occupational environment is not warranted." O. Ex. 9(a)(2) at p. 17.

All of the evidence, without exception, indicates that we cannot fairly utilize workplace standards as evidence of safety for home use. Those experts who were asked to estimate the level of exposure that would be safe in homes uniformly estimated that much lower level of exposure would be necessary in homes than in workplaces.

C. Clinical and Epidemiological Studies on Humans.

We lack epidemiologic and clinical studies of the long-term effects of formaldehyde vapor on humans. As with animal studies, the most serious deficiency in our knowledge concerns the effect of continuous exposure over long periods of time. The number of studies are few. Representative studies are discussed below.

1. One Soviet clinical study was conducted in 1971 on human subjects, aged 17 to 44. The subjects were subjected to four formaldehyde vapor concentrations ranging from 54 mg/m^3 to 90 mg/m^3 (approximately .046 to .075 ppm). Formaldehyde at a concentration of 73 mg/m^3 (approximately .06 ppm) was detected by 7 of the 15 tests subjects. The "subliminal concentration" was 54 mg/m^3 (approximately .046 ppm). When the 5 subjects shown to be the most sensitive to odor were given EEG's, concentrations of 53 mg/m^3 (approximately .046 ppm) produced reliable changes in the cerebral electric activity in all of the subjects. A concentration of 40 mg/m^3 (approximately .035 ppm) exhibited no effect on cerebral bioelectric activity. O. Ex. 9(u) at p. 122.

2. Another Soviet study in 1968 subjected 11 people to 14 formaldehyde tests. The tests revealed an orientation reaction, odor, irritation of the upper respiratory tract, accelerated breathing and ECG changes at 1000 mg/m^3 (approximately .8 ppm). Exposure to 300-400 mg/m^3 (approximately .30 ppm) resulted in an orientation reaction in most subjects and an odor response in half the subjects. No significant EEG changes were recorded. O. Ex. 9(u) at p. 123.

The level of formaldehyde exposure which produces significant EEG response differs by a factor of 10 in these two Soviet studies. Sufficient information on experimental methodology and collected data is not available to evaluate the results of the studies according to the EPA report in which they appear. "Additional well-controlled human exposure studies to low concentrations of formaldehyde...are necessary to establish to the subtle effects of this chemical on the body." Id. at 123.

3. State Health Departments in Wisconsin and Washington have conducted extensive surveys of people with health complaints associated with formaldehyde vapors emitted by UFFI and/or particle board. These investigations were careful and thorough, but were limited to complaining parties and cannot be considered equivalent to a true epidemiological study. The evidence gathered by Prof. Breysse at the University of Washington and by Mary Ann Woodbury and Dr. Carl Zenz on behalf of the Wisconsin Division of Health nonetheless contributes to the small amount of evidence of the effects of formaldehyde vapor on humans presently available.

Prof. Breysse's work was done for the most part in mobile homes. His original sampling compiled the symptoms of 92 people in 74 mobile homes who experienced adverse reactions believed attributable to formaldehyde. His results showed:

Symptoms	Number of People With Symptom	% of Sample
Irritation - eyes	80	87%
- nose	12	13%
- respiratory tract	58	63%
- headache	51	55%
- nausea	12	13%
- drowsiness*	26	28%

*Note: Sometimes described as lapse of memory.

P. Ex. 18, p. 7.

In addition he reported that some people felt chronically ill and a number mentioned difficulty in breathing. Some very young children experienced chronic problems. For example, one newborn experienced chronic respiratory problems. In another home, a two year old had a constant cold while a three month old suffered chronic running nose. In one home a year old child had a chronic low grade fever. One two year old suffered from asthma. Another two year old had chronic ear infection

Acknowledging that all of these reported symptoms could have originated from sources other than formaldehyde, Prof. Breysse also pointed out that all people reported relief from symptoms while away from home on weekends or vacations, and rapid onset of the same symptoms on returning home. Many saw more than one physician without success.

Apparently after publication of Prof. Breysse's early mobile home results, Prof. Breysse investigated 39 complaints received from people with UFFI-insulated homes in the Seattle area. The homes were tested for formaldehyde levels and reported symptoms were noted. T. 120-5. A summary of the results of these investigations indicated that 14 adult males, 18 adult females, and 12 children experienced the following symptoms:

	ADULTS				CHILDREN	
	Females		Males			
Symptoms	Number	% of Sample	Number	% of Sample	Number	% of Sample
Irritation:						
-eyes	12	67%	5	36%	0	0%
-nose	4	22%	4	29%	4	33%
-respiratory tract	12	67%	6	43%	0	0%
Chronic headache	1	.5%	1	7%	1	8%
Chronic nausea	2	11%	0	0%	0	0%
Drowsiness or memory lapse	2	11%	3	21%	0	0%
Chronic cold	0	0%	0	0%	2	17%
Chronic cough	3	17%	1	7%	3	25%
Chronic sneezing	1	5%	2	14%	1	8%
Difficulty in breathing	1	5%	1	7%	0	0%
Dry or runny nose	1	5%	0	0%	0	0%
Sore or dry throat	3	17%	1	7%	0	0%
Diarrhea	0	0%	1	7%	0	0%
Allergies	1	5%	3	21%	4	33%
Sinus problems	1	5%	1	7%	0	0%
Asthma	1	5%	0	0%	0	0%
Skin rash	1	5%	0	0%	0	0%

The formaldehyde levels reported in the homes in which these symptoms occurred were reported as follows (at least two samples were taken during each investigation):

Formaldehyde Levels (ppm)	Number of Samples			
	Bedroom	Kitchen	Other	Total
≥ 1.0	6	3	4	13
≥ 0.5 to 0.99	2	1	3	6
≥ 0.10 to 0.49	21	13	15	49
< 0.1	12	1	12	25
TOTAL	41	18	34	93

Breysse said that 80% of the samples taken from homes in which people were complaining showed levels below 0.5 ppm. P. Ex. 17, p. 7. Even with levels below 0.10 ppm some people reported symptoms. T. 116.

Breysse said that the most common symptoms which people experienced were "irritation of the eyes, nose, and respiratory tract, chronic headache, chronic nausea, and chronic drowsiness" or memory lapses. A few people developed rashes, bronchial asthma, and personality changes. T. 105, 109. People with allergies and respiratory problems "are much more susceptible to the effects of formaldehyde." T. 109. "(A) few infants. . .developed very severe problems upon arriving home (which) continued until the baby (was) removed from the home," Breysse testified. T. 108.

The people living in UFF insulated house complained most when it rained or the temperature was high. Almost without exception their symptoms moderated or abated when they left their home but returned shortly after they came back. T. 106-7.

Experts for the opponents have extensively critiqued Prof. Breysse's data and conclusions. O. Ex. 125-126. Although heavily critical of Breysse's conclusions, opponents Tabershaw Occupational Medical Associates find his analytical data acceptable, and join Prof. Breysse in noting the correlation between reported symptoms and symptoms typical of formaldehyde exposure (irritation of the eyes, nose and respiratory tract, headaches, nausea, drowsiness). These opponents consider the Breysse evidence sufficient to conclude that formaldehyde is present in some of the nation's mobile homes; they find that the evidence suggests that some mobile home residents with detectible levels of formaldehyde vapor have symptoms characteristic of formaldehyde exposure.

Opponents point out, however, that the sample was not random, that the symptoms reported cannot be separated into "subjective" and "actual" signs of injury, and that illness caused by agents other than formaldehyde is not segregable from formaldehyde-induced effects. The complaints investigated generally arose in response to public information about Breysse's work; the authors of the critique therefore believe the sample biassed. Opponents speculate that the symptoms were solicited by biassed interrogation as well.

These opponents also maintain that the data does not demonstrate the expected relationship between incidence of symptoms and concentration of formaldehyde. Opponents suggest several possible reasons for this:

(a) The people included in the study are all hyperallergenic.

(b) The anecdotal representation of symptoms was biassed.

(c) All people in the group acted similarly regardless of exposure level.

These opponents do not, however, consider whether Breysse's results show that normal individuals may react at lower levels of formaldehyde exposure than these opponents believe to be characteristic.[9]

Concluding overall that well-designated environment and epidemiological studies are seriously needed and that dose-response relationships remain unpredictable, the opponents also state that the Bréysse findings support the setting of preliminary guidelines for formaldehyde vapor limits. They recommend a residential limit of .5 ppm, cautioning, however, that even at this exposure "hyperallergenics would be at risk of significant discomfort," and that this is only a hypothesis, much in need of confirmation by epidemiological study.

The only other extensive review of symptoms reportedly due to formaldehyde exposure has been compiled by Mary Ann Woodbury of the Wisconsin Division of Health and by Carl Zenz, M.D. These results appear in P. Exs. 28, 29, 32, 35 and 57, and corroborate the evidence gathered by Dr. Breysse. These results, as Prof. Breysse's, must be considered not as controlled, well-constructed epidemiological studies, but as available but limited evidence of potential risk in the absence of more complete scientific study. Many factors uncontrolled in Prof. Breysse's investigation were extensively pursued by Zenz and Woodbury, however.

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[9] This may be significant as these opponents believe that a response will be induced at formaldehyde levels higher than the vapor levels reported elsewhere:

Physiologic Effect	Probable Response Dose
Hyperallergenic	< 0.01
Hypersensitive	< 1.00
Sensitive	1.0 - 3.0
Insensitive	> 3.0

O. Ex. 126

Fifty seven homes and 107 inhabitants were involvec in the study; seven of those homes contained UFF insulation, while fifty contained only particle board. Only one home involved both UFF and particle board. Indoor formaldehyde readings ranged from 0.02 to 4.82 ppm, whereas outdoor readings were from 0.0 to 0.3 ppm. T. 2-165, 2-175, 2-180 to 2-181. Medical interview questionnaires were filled out for each person. Formaldehyde readings were taken in each home. Each patient's physician was contacted in person or over the telephone, and other environmental contaminants and factors were sought and considered. These contaminants and factors included carbon monoxide, hydrogen sulfide, sulfur oxides, phenols, dusts, other fumes, infections, allergic conditions, smoking habits, heating and air conditioning, medications, and investigation of a patient's medical and hospital records. P. Exs. 32, 33, 35, 57.

Symptoms reported by 85 individuals included:

73%	Eye irritation.
53%	Upper respiratory irritation, including dry or sore throat, cough, runny nose.
23%	Headaches.
23%	Restlessness, tiredness.

T. 2-165 to 2-166.

Only 24% of the 85 individuals had prior existing chronic health problems, such as asthma, allergies, chronic lung disease, or coronary heart disease. Thirty percent of all the people over 17 smoked, slightly lower than the national average of 32%. Two of 21 adults were hospitalized. (T. 2-167 to 2-176).

D. Effects on Children.

The evidence indicates that formaldehyde vapor may affect very young children more seriously than adults. Experts include children in a category of particularly vulnerable individuals which also includes the very old, those with respiratory ailments, and those sensitive or allergic to formaldehyde. Experts on both sides agree with this categorization, many emphasizing the urgency of the need for more extensive study of adverse effects on these sub-populations. O. Ex. 47 (Dr. Lepow, a pediatrician); O. Ex. 125-6 (Tabershaw Occupational Medicine Associates); O. Ex. 131(c) (Dr. Hine); T. 2-308 (Dr. Lyman); P. Exs. 32, 35, 42 (Woodbury and Zenz); P. Ex. 18; T. 103 et seq. (Prof. Breysse); T. 86-87 (Dr. Landrigan, a pediatrician).

The studies conducted both by Breysse and by Woodbury and Zenz noted particularly acute symptoms in very young children. Prof. Breysse notes that very young infants appear to be much more susceptible to severe respiratory problems. T. 108. A few infants in his study were brought into the home shortly after birth and immediately developed very serious problems; the ill-health persisted until the baby was removed from the home. T. 108. Prof. Breysse comments that infants, especially newborns, spend most of their first year of life indoors such that exposure may continue 24 hours per hour for months at a time. P. 18.

The Woodbury and Zenz data assessed the effects on infants separate from adult reports, and found that 5 of 10 infants required hospitalization. P. Ex. 32. Possible birth defects from prenatal exposure were also noted. Characteristic symptoms in infants less than 6 months of age included vomiting, diarrhea, watery eyes, restlessness, excessive crying, and refusing food other than mother's milk. In each case the infant's symptoms disappeared on removal from the home, recurring only on return. The formaldehyde levels at which these symptoms were reported for some of these infants was described as follows:

Case File No. Infants	Formaldehyde (in ppm's)
20	1.98, 1.71, 1.95, 1.85
35	0.67, 0.73, 0.73, 0.85, 1.12, 0.68 0.77, 0.79
46	1.54, 1.35, 1.99, 1.93, 1.29, 2.5, 2.92, 2.91, 2.87, 2.6
53	0.06, 0.18, 0.22X2, 0.24X2, 0.25, 0.30
63	0.22, 0.22, 0.25, 0.19, 0.24, 0.28, 0.22, 0.25
70	0.90, 0.84, 0.84, 0.68, 0.88, 0.82, 0.82
68	.68 - .90

Overall range: 0.06 - 2.92 ppm P. Ex. 32

Woodbury and Zenz concluded that there is little doubt that some infants will respond to formaldehyde vapor between 0.67 and 7.00 ppm with restlessness, vomiting and diarrhea often severe enough to necessitate hospitalization. P. Ex. 32.

A pediatrician who testified offered his expert opinion that children represent an especially vulnerable sub-group; he would expect on the basis of his experience with many other toxic compounds that children would be susceptible to doses ten-fold or even one hundred-fold lower than the adult working male on whom most previous studies have been conducted.

Although a physician and toxicologist testifying on behalf of the opponents, Dr. Lyman, disagreed with Ms. Woodbury's analysis of why infants suffer more severe symptoms than adults (T. 2-306), no experts denied that small babies are likely to be uniquely vulnerable to formaldehyde vapors. See, e.g. T. 2-308.

The effect of this sensitivity is not only to increase the severity of the health symptoms experienced, but to induce adverse health effects on exposure to minute or even trace doses of the chemical vapor. On this issue most proponents and opponents again agree. P. Ex. 60(b); P. Ex. 55; O. Ex. 125-6; T. 244 and O. Ex. 102. Compare T. 284-285.

3. Toxicity of Formaldehyde.

Some of opponents' experts refused to label formaldehyde "toxic" (see, e.g. T. 2-305), while other exhibits described formaldehyde generally as "toxic" when inhaled.(e.g. O. Ex. 9(c); O. Ex. 9(t); O. Ex. 9(r)). EPA concludes that formaldehyde is toxic to most forms of life, its toxic properties resulting in lung hemorrhages and edema, respiratory collapse and death. O. Ex. 9(u) at 179. Those who refused to call formaldehyde "toxic" insisted that toxicity depends on the dose; even these experts, however, conceded that formaldehyde vapor in certain concentrations is toxic to humans. See, e.g. T. 2-223; T. 2-305. Formaldehyde vapor inhalation may even be lethal.[10] O. Ex. 47.

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[10] Formaldehyde vapors have also been shown potentially carcinogenic, teratogenic and mutagenic.

Drs. Hine and Clary cited an animal study revealing teratogenic effects. Some opponents remain persuaded that formaldehyde is not teratogenic in spite of this study. (T. 235; O. Ex. 7).

Dr. Craigen joined EPA in reporting a Soviet study possibly linking formaldehyde with interferance in the reproductive function of women workers. Experts note that the studies reflecting the mutagenicity of formaldehyde are in conflict, however. Further study is planned.

Most experts testified that no evidence has yet emerged linking formaldehyde with cancer in animals or humans. Compare P. Exs. 26 and 61. See Addendum for discussion of new evidence concerning carcinogenicity.

Although DPH has not proposed to regulate formaldehyde based upon its carcinogenicity, teratogenicity or mutagenicity and does not rely on these potential effects in reaching this decision, testimony received on these issues indicates that further testing is desperately needed to confirm or deny suggestions of these deleterious effects.

F. Expert Opinions and Regulatory Standards Concerning Safe Levels of Formaldehyde Vapors in Homes.

The full extent of the danger posed by long-term, low-level exposure to formaldehyde vapors in homes remains unknown. It is hypothesized that such exposure may result in chronic respiratory disease (O. Ex. 47; see also P. Ex. 60(b)). The experiments of Drs. Alarie and Kane suggest that repeated exposure may result in an increasingly severe response. P. Ex. 63(e).

Opinions tendered concerning safe levels for formaldehyde exposure in homes ranged from .003 ppm (Drs. Kane and Alarie) to 1 ppm (Dr. Lepow). Those most intimately involved with the people suffering health effects induced in residential settings recommend standards at the low end of this spectrum: Woodbury and Zenz recommend .1 ppm, cautioning that this may be yet too high given the serious symptoms experienced by one infant at .2 ppm. All opinions fell well below the current occupational recommendations and requirements for an ordinary work-week. The only available government standards are among the lowest estimates available: The Netherlands permits no more than .02 ppm two months after UFFI installation, while the Soviet Union limits non-occupational formaldehyde exposure to .01 ppm. The German Health Ministry has established .1 as an in-home standard. The full range of opinions presented appears in appended chart #1, part I, on page 59.

More than one expert testified that there is no safe level of formaldehyde exposure for very young or newborn infants or for people with pre-existing respiratory ailments or hypersensitivity. E.g. T. 114-5; P. 60(b); T. 244-5. Very young infants, whose exposure may be continuous for months at a time, cause particular concern. A pediatrician who testified stated that a ten to one hundred-fold adjustment must be made in workplace standards in order to insure safe levels for infants. Available standards and opinions concerning safe levels of workplace exposure range from .3 ppm to 3 ppm. A ten to one hundred-fold adjustment would reduce this range to .03 to .3 ppm or .003 to .03 ppm.

G. Conclusions Concerning Health Effects of Formaldehyde.

Formaldehyde vapors can cause eye, nose, throat and other respiratory irritation, lacrimation, nausea, headaches, dizziness, drowsiness and other detrimental health effects to humans. The extent of the injury induced may vary from individual to individual, and may be aggravated as the vapor concentration is increased. Some adult workers have been affected at levels as low as .13 ppm in workplace settings. Sensitized individuals suffer symptoms at minute or trace levels of formaldehyde vapors. Infants are more seriously affected by formaldehyde gas than adults and may suffer substantial injury even at very low levels of formaldehyde exposure.

There is no level of formaldehyde vapor that has been proven safe up to 24 hours per day, seven days weekly, over an individual lifetime. The available evidence demonstrates that formaldehyde has the capacity to produce personal injury or illness to humans on inhalation or absorption through body surfaces. Foraldehyde is therefore "toxic." On immediate, prolonged or repeated contact with normal living tissue formaldehyde will induce a local inflammatory reaction. Formaldehyde is therefore an "irritant" within the meaning of the statute. Residential exposure to formaldehyde vapors even at very low levels may cause personal injury or substantial illness during or as a proximate result of customary or reasonably forseeable handling or use.

Although the consensus of medical opinion would consider formaldehyde a "strong sensitizer", the Massachusetts statute mandates a finding that formaldehyde has a significant potential for causing hypersensitivity based on the frequency of sensitive reactions as well as the severity of the response. Lacking evidence of the number of individuals experiencing hypersensitive reactions, there is no basis for coming to a conclusion about the frequency of hypersensitivity. Formaldehyde, therefore, is not a "strong sensitizer" within the meaning of the statute.

CHART #1

STANDARDS AND OPINIONS CONCERNING
SAFE LEVELS OF FORMALDEHYDE VAPORS

I. In Homes

A. GOVERNMENT STANDARD IN THE NETHERLANDS (P. Ex. 60(b); O. Ex. 13(c)):

(1) The maximum concentration permitted within 2 weeks of UFFI installation is .5 ppm.

(2) The maximum concentration permitted 2 months after UFFI installation is .02 ppm.

B. GOVERNMENT STANDARD IN THE SOVIET UNION (P. Ex. 60(b)):

Maximum non-occupational level is .01 ppm.

C. GOVERNMENT STANDARD IN GERMANY (From "Responses to Questions Regarding Formaldehyde Data-Effects" by Rapperswill Corporation):

In October, 1977, the German Health Ministry established .1 ppm as the standard of formaldehyde concentration in homes.

D. AMERICAN INDUSTRIAL HYGIENE ASSOCIATION (P. Ex. 42):

In-home recommended limit is .1 ppm.

E. OPINION OF DR. LEPOW (O. Ex. 47):

Exposure to 1 ppm or less is not a significant health hazard.

F. OPINION OF DR. HINE (O. Ex. 131(c)):

It is improbable that .1 ppm or less could cause any detectible effect.

G. OPINION OF DR. CRAIGEN (T. 296):

A "guess" is that .5 ppm would be reasonable for the general population.

H. OPINION OF DRS. KANE AND ALARIE (Proponents Exhibit 63(f); T. 134-5):

(1) .03 ppm is the highest concentration to which home inhabitants in the U.S. should be exposed.

(2) A .003 ppm limit would be preferable.

I. OPINION OF WOODBURY AND ZENZ (P. Ex. 42):

A reasonable interim standard would be .1 ppm.

J. TABERSHAW OCCUPATIONAL MEDICAL ASSOCIATES (O. Ex. 125-6):

A limit of .5 ppm is hypothesized; hyperallergenics would be at risk of serious discomfort even at this level.

II. In Workplaces

A. NIOSH RECOMMENDATION (O. Ex. 9(a)(2)):

(1) The maximum workplace exposure permitted is 1 ppm over 30 minute sampling period.

(2) Increased monitoring and surveillance are required at .5 ppm.

(3) A limit of 2 ppm is too high.

B. OSHA REGULATION:

(1) The maximum workplace exposure permitted is 3 ppm as a time weighted average over an 8 hour day in a 40 hour week.

(2) Exposure to 5-10 ppm is permitted over a 30 minute sampling period.

C. ACGIH RECOMMENDATION (O. Ex. 9(u)):

(1) The maximum workplace concentration permitted is 2 ppm at 25°C.

(2) An excursion above 2 ppm for up to 15 minutes is not acceptable.

D. U.S. NAVY REQUIREMENT FOR SUBMARINES (O. Ex. 142):

(1) The confined space guideline for 90 days is .5 ppm.

(2) The 24 hour limit is 1 ppm.

(3) The 1 hour emergency limit is 3 ppm.

E. MANNED SPACECRAFT LIMIT (P. Ex. 89):

(1) 60 minute limit: 1 ppm

(2) 90 day limit: .1 ppm

(3) 6 month limit: .1 ppm

F. OPINION OF DRS. KANE AND ALARIE (P. Ex. 63(e)):

(1) The threshold limit value (TLV) must be restricted at or below .31 ppm in workplaces.

(2) A possible TLV range of .03 to .3 ppm should be considered.

(3) A TLV of 2 ppm is too high.

G. STANDARD IN THE SOVIET UNION (P. Ex. 60(b)):

Maximum occupational exposure is .1 ppm.

H. OTHER STANDARDS (O. Ex. 9(a)(2) at p. 161):

The NIOSH report includes a list of workplace standards in effect as of December, 1976 in countries outside the United States and in individual states within the United States.

CHART # 2

SYMPTOMS CAUSED BY INHALATION OF FORMALDEHYDE BY HUMANS*

(Due to biological variation, experts agree that these estimates may vary greatly from individual to individual.)

ppm's	
.01	Eye irritation threshold (EPA).
.01 - .05	First causes irritation to eyes (T. 71 Dr. Landrigan).
.05	First detectible to smell (T. 71 Dr. Landrigan; p. Ex. 60(b)).
.06	Odor threshold in highly sensitive people (EPA; O.Ex. 109 Dr. Bidstrup).
.07	Chronaximetric response threshold (EPA).
.073	Perceived as odor (P. Ex. 32).
.08	Cortical reflex threshold (EPA).
.13 - .45 Occup. Exposure	Workers experienced headaches, intolerable irritation of eyes, nose and throat, and one illness (Dr. Alarie; also cited by EPA as "irritant threshold").
.2	Mobile home dwellers report eye, nose and respiratory irritation, and less frequently, headache, nausea and dizziness. Permanent damage, other than induces sensitivity, is unknown. (Dr. Nine).
.25 - 5	Irritant threshold (EPA).
.25 - 1.39 Occup. Exposure	Upper respiratory tract irritations, burning of eyes and nose, sneezing, coughing, headaches (Dr. Alarie).
.3 Occup. Exposure	A few employees report symptoms (NIOSH).

*Some of the sources cited for these figures are reports (e.g. EPA, NIOSH) that review existing studies. This chart lists only the report in which the study is cited, and not the name, author or date of the study itself. The EPA study is O. Ex. 9(u); the NIOSH report is O. Ex. 9(a)(2); Dr. Alarie's chart appears in P. Ex. 63(e).

ppm's		
.3 - 3	. . . . .	Upper respiratory irritation (P. Ex. 60(b) Dr. Rumack; T. 71-7 Dr. Landrigan)
0.4 - 0.8	Occup. Exposure . . .	Chronic airway obstruction; lowered FEV1.0 FVC ratio; acute exposures caused eye, nose and throat irritation, and lower respiratory tract symptoms (Dr. Alarie).
.5	. . . . .	Odor threshold (EPA).
.5	. . . . .	"Vast, vast majority of people" are free of "significant symptoms" (T. 2-302 Dr. Lewis).
.5 - 1	. . . . .	Odor threshold for "normal" people. Will seldom cause irritation of eyes, nose or throat (O. Ex. 109 Dr. Bidstrup).
.8	. . . . .	Slight irritation (EPA).
.9 - 1.6	. . Occup. Exposure .	Workers experienced intense irritation, itching of eyes, dry and sore throat, increased thirst, disturbed sleep. (Dr. Alarie; also cited in EPA as "irritant threshold.")
.13 - 1.6	. . . . .	Coughing, stinging eyes, headaches, throat and nose irritation, disturbed sleep, increased thirst (P. Ex. 32).
less than 1 ppm	. . . . .	Reported to cause central nervous system response (EPA).
1 ppm 1	. . . . .	A certain number will react with irritation; few, if any, will show significant irritation (T. 2-298 Dr. Lewis).
1	. . . . .	Only a few highly susceptible people are affected (T. 2-264 Dr. Cummin).
1	. . . . .	Odor is detected by most people (O. Ex. 7 Formaldehyde Institute).
1	. . . Occup. Exposure	General complaints are made by employees (NIOSH).
1	. . . . .	Odor threshold (EPA).
1	. . . . .	Odor and irritation threshold (O. Ex. 109 Dr. Bidstrup).
1	. . . . 5 min	8% of test panel reported eye irritation (Dr. Alarie).
1 - 2	. . . . .	Irritating or annoying to some (NIOSH).

ppm's		
2-3 ppm	2 . . . . 12	24% of test panel reported eye irritation (Dr. Alarie).
	2 - 3 . . Occup. Exposure . . .	Over 8 hours, study showed this level tolerable, causing mild tearing of the eyes, nose and post rior pharynx (EPA and O. Ex. 7 Formaldehyde Institute).
	2 - 3	Tingling of eyes, nose and throat (Dr. Alarie).
	2 - 3	Some react with irritation; many do not (T. 2-298 Dr. Lewis). The majority will tolerate this level without apparent effect or discomfort (O.Ex.109 Dr. Bidstrup).
	2 - 4 . . 5 min	33% of test panel reported eye irritation.
	4 . . . . 5 min	Severe eye irritation (Dr. Alarie).
	4 . . . . 5 min	100% of test panel reported eye irritation.
4-5ppm	4 - 5	Mild tearing of the eyes, nose and pharynx and moderate discomfort (O. Ex. 7 Formaldehyde Institute).
	4 - 5 . . 10-30 min	Irritation, discomfort, lacrimation; some tolerance develops; tolerable for some, not all (Dr. Alarie).
	4 - 5	Over 10-30 minutes, intolerable to most people; very unpleasant, mild lacrimation (EPA).
	4 - 5	Intense irritation of upper respiratory tract (T. 71-2 Dr. Landrigan).
5ppm	5	Throat irritation threshold (EPA).
	5	Exposure can cause damage to the respiratory system; bronchitis, laryngitis, and possible broncho pneumonia may result (EPA).
	5 . . . 5-20min	Asthmatic attacks (Dr. Alarie).
	5 - 10	Almost all people will have irritation of the eyes, nose and throat (T. 2-298 Dr. Lewis).

	ppm's	
10ppm	10	A few minutes' exposure causes profuse lacrimation (EPA).
	10	Causes immediate, strong discomfort (O. Ex. 7 Formaldehyde Institute).
	10 or more	Can cause severe respiratory problems, difficulty in breathing, pulmonary edema, asthma (T. 71-2 Dr. Landrigan; P. Ex. 60(b) Dr. Rumack).
over 10ppm	10.5	Has caused allergic dermatitis in hypersensitive people (NIOSH).
over	10	It would be reasonable to anticipate that symptoms would be more severe and would inlcude headache, nausea and drowsiness (O. Ex. 44 Dr. Lewis).
	10 - 20	Short-term exposure produces immediate eye irritation and sharp sensations of the nose and throat which may be associated with sneezing, difficulty in taking a deep breath and coughing (Exhibit 9(c).
	12	Severe irritation (Dr. Alarie).
	13.8 . . . 30 min	Nasal and eye irritation and lacrimation (Dr. Alarie).
	20	Lacrimation after 10-30 seconds. Irritation of nose and throat after 30 seconds. Sneezing within 1-2 minutes (EPA; also cited by Dr. Alarie).
over	50	Damage to eyelids reported (EPA).
	50 - 100	May cause very serious damage in 5-10 minutes (EPA).

VI. Causation

A. Inferences Drawn from the Evidence.

Subsequent to the installation of UFFI in homes of consumers, but not prior to such installation, people inside these homes began experiencing eye and respiratory irritation, difficulty in breathing, nose bleeds, nausea, tiredness, headaches, dry skin, and other symptoms. The symptoms reported by different consumers, while not always identical, are very similar. These symptoms routinely subsided when the home, or the insulated portion of the home was temporarily vacated and returned when the home was again inhabited. Similarly abandonment of the homes resulted in the disappearance of the symptoms. Did the UFFI cause these symptoms?

These symptoms are nearly identical with symptoms and responses associated with exposure to formaldehyde, a substance which UFFI releases. Formaldehyde is historically known to cause eye and respiratory irritation, difficulty in breathing, nose bleeds, nausea, tiredness, headaches, dry skin and other symptoms. Scientific evidence shows that symptoms of formaldehyde exposure abate when exposure to the chemical gas ceases. Each of these features of formaldehyde is present in the Massachusetts experience with UFFI described above. And UFFI emits formaldehyde. Moreover there has not been established a level below which formaldehyde exposure is safe and below which these symptoms do not appear. These factors lead me to conclude that consumers are experiencing these symptoms as a result of exposure to formaldehyde at whatever level occurs in the particular case.

Does UFFI cause or contribute to the formaldehyde which is causing these symptoms? UFFI emits formaldehyde. The amount and frequency of formaldehyde emissions of UFFI in the Massachusetts and other experience is not known. The symptoms of the consumers are intimately associated both in time and by way of

physical proximity with UFFI. The onset of these symptoms followed closely the installation of UFFI in the homes of consumers. Symptoms appeared only when inside the homes. When the homes were vacated, temporarily or permanently, symptoms routinely abated but returned again when the home was again inhabited. Additionally removal of UFFI from homes resulted in the disappearance or significant abatement of the symptoms. These factors, when taken together, indicate that the presence of UFFI in these homes is the cause of or a material contributor to the formaldehyde which causes adverse health effects.

B. Opponents' Arguments Concerning Causation.

Opponents have offered several arguments to rebut the inference that UFFI was the cause of injurious health effects experienced by proponents. Opponents argue that:

(1) Formaldehyde is emitted from products other than UFFI and is present in the ambient air in non-UFFI homes; therefore, even if proponents' symptoms were induced by formaldehyde vapors, these vapors may have been issued from products other than UFFI.

(2) The amount of formaldehyde present in the outside ambient air and in non-UFFI homes is the same as or higher than the amounts found in UFFI-insulated homes; therefore, vapor levels in UFFI homes are no more injurious to health than vapor levels found elsewhere.

(3) Formaldehyde and other gases may appear in UFFI homes because the insulation is thermally efficient and traps gases that are emitted from sources other than UFFI.

Each of these points is discussed below.

(1) Formaldehyde emissions from sources other than UFFI and in non-UFFI homes.

Opponents introduced lists of common household products containing formaldehyde, such as cosmetics, clothing, drapes, carpets, cooking gas, plywood and particle board. They argue that formaldehyde is not an uncommon or exotic ingredient, and that any of these other formaldehyde-based products may be the source of formaldehyde vapors in residential buildings. Evidence that formaldehyde vapors are detectible in homes without UFFI is offered to corroborate this point.

Opponents have submitted scant evidence that any of these household articles containing formaldehyde actually emits formaldehyde vapors into the home, however. The evidence that has been submitted is summarized as follows:

(a) The available evidence concerning emissions from products other than UFFI.

(b) Formaldehyde levels in non-UFFI homes.

(c) Conclusion.

(a) Formaldehyde emissions from other household products.

(1) Emissions from wood products: The most extensive evidence submitted showed the vapor emission properties of wood products like particle board, chipboard and plywood. These products are bonded by a synthetic resin, usually urea-formaldehy Prof. Breysse reports that free formaldehyde in particle board and chipboard may be released over time after manufacture. Vapor emission from plywood may be less, as much of the gaseous formaldehyde is released when the wood is pressed during manufacturing. Nonetheless, small amounts of vapor are given off by plywood after shipment and after installation.

For both particle board and plywood, formaldehyde emissions depend on a number of factors, such as amount of free formaldehyde in the panels, amount of exposed surface area, temperature and humidity and amount of ventilation, among other factors. P. Ex. 18 at p. 4.

Attempting to quantify the amount of vapor released from wood products, Prof. Breysse measured the formaldehyde levels in 74 mobile homes. The formaldehyde levels in the mobile homes tested ranged from 0 to 2.54 ppm. P. Ex. 18. Prof. Breysse believes that these vapor readings are attributable to wood products containing formaldehyde, although he was not able to isolate other potential sources of formaldehyde.

Woodbury and Zenz have taken measurements they call a "bulk sample analysis of free formaldehyde in this (one) home." This analysis showed:

Woodchips fro cabinets and closets	370 micrograms per gram
Chips used for floor (2 samples) means of	439 micrograms per gram
Foam insulation	4,636 micrograms per gram

P. Ex. 42

While this data appears to suggest that UFFI emits more than woodchips, we cannot assess these results without knowing more about the tests, e.g., how the measurements were made and exactly what they purport to measure. DPH has not to date received complaints concerning wood products comparable in number or seriousnes to complaints about UFFI. Overall, this evidence does not permit us to quantify the amount of vapor emitted by these wood products in conventional homes or to compare it to emissions from UFFI.

(2) Emissions from cooking gas: We have one test quantifying the amount of formaldehyde vapor arguably contributed by gas stoves. A report by Dr. Firstman states that the background concentrations of formaldehyde in the kitchen of a single non-UFFI home in the Netherlands showed .02 ppm before cooking and .58 ppm after.[11] O. Ex. 147 at p. 22. Lacking more extensive sampling under controlled circumstances, these test results remain of limited value.

(3) Emissions from other products: Other evidence concerning emissions from household products containing formaldehyde is similarly sparce and cannot be used to quantify the amount of vapor released from these products. For example, Dr. Cummin reports that cigarette smoke contains 40 ppm formaldehyde (T. 15); Dr. Lepow says that 10 cigarettes smoked in a 20 cubic meter room result in .45 ppm formaldehyde (O. Ex. 47); according to Dr. Bidstrip, a single low-tar cigarette smoked in a 1500 cubic foot closed room has raised the formaldehyde concentration to .5 ppm. (O. Ex. 109). See also O. Ex. 148.

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[11] Dr. Firstman has concluded that cooking with natural gas contributes .01 to .05 ppm in New York homes. O. Ex. 14. His data base as described in O. Exs. 14-16 does not demonstrate any factual foundation for this conclusion.

See also footnote 12, page 75 for discussion of a post-hearing submission concerning cooking gas.

(b) Formaldehyde levels in non-UFFI homes.

A study by Dr. Firstman reports the formaldehyde concentrations in 10 brick homes in the Netherlands. These homes contained neither UFFI nor particle board. O. Ex. 147 at p. 20. The levels reported are as follows:

AIRBORNE FORMALDEHYDE IN HOUSES -- WITHOUT UF FOAM INSULATION (No Particle Board)

House	Concentration (ppm)*
1	0.03 - 0.04
2	0.01 - 0.02
3	0.02 - 0.06
4	0.03 - 0.03
5	0.06 - 0.09
6	0.03 - 0.03
7	0.03 - 0.03
8	0.09 - 0.12
9	0.00 - 0.02
10	0.01 - 0.02
Outside air at house No. 9	0.00 - 0.01

*Data shows spread due to measuring formaldehyde using two chemical methods.

Dr. Firstman also reports that 15 non-UFFI homes made of timber in Sweden showed an average of .4 ppm formaldehyde. Twenty concrete block homes in Sweden showed an average of .2 ppm formaldehyde. "There were no complaints of formaldehyde odor in any of these houses." O. Ex. 147 at p. 22.

In this country, Borden, Inc. tested the formaldehyde levels in the homes of nine of Borden's employees who did not have UFFI in their homes. Each home was tested inside and out on a single day. The homes were located in Leominster and North Andover. Inside formaldehyde readings ranged from less than .01 to .08 ppm. Outside levels ranged from less than .01 to .07 ppm. The outside level was the same as the inside level in 4 homes. In four homes, indoor readings exceeded outdoor by .01. In one home the inside level was .02 higher than the outdoor reading. In a single home, the level inside was .02 ppm lower than the outdoor level.

Although these tests show that homes without UFFI may have detectible levels of formaldehyde vapor, they do not permit us to draw any conclusions concerning the amount of formaldehyde emitted from products other than UFFI.

(c) Conclusion

In toto, this evidence does not permit us to determine with any degree of accuracy the contribution made by non-UFFI products to the formaldehyde problem.

While opponents argue that Massachusetts UFFI consumers may have suffered from vapor emitted by other household products, they have not presented evidence explaining why most of the proponents experienced symptoms characteristic of formaldehyde exposure closely following installation of UFFI in their homes but not before. Opponents' lists of items containing formaldehyde do not include any product(s) that entered the homes of the proponents in the same time relationship as did UFFI. Many of the UFFI consumers testified that they had used such formaldehyde-based products as cooking gas and cigarettes for years in the same home, yet had never before experienced symptoms similar to those occurring only after installation of UFFI.

Even were we to find that other products containing formaldehyde do contribute to formaldehyde levels in UFFI homes, we have also concluded that UFFI emits formaldehyde as well. The formaldehyde-emitting property of UFFI, coupled with the connection between UFFI symptoms and onset of symptoms, rebuts any suggestion that other sources alone account for the illness experienced. Rather, the evidence shows that UFFI either causes or substantially contributes to the accumulation of formaldehyde vapors in the home.

(2) Amount of formaldehyde in outside ambient air and in non-UFFI homes.

Opponents maintain that ambient air in various cities outside of residential buildings contains formaldehyde levels ranging from .04 ppm to .12 ppm or higher in some extreme instances. See, e.g., O. Ex. 9(u), pp. 94-98; O. Ex. 16. See also T. 110. Opponents also tendered the results of a small test of ambient air levels in 9 Massachusetts homes without UFFI (O. Ex. 149) and 5 air readings air various locations in and around the Boston area (O. Ex. 150). Formaldehyde readings in the homes ranged from .01 to .08 ppm, while the outside readings showed .01 to .07 ppm. See also formaldehyde readings in homes in the Netherlands and Sweden described in (1)(b) above. Opponents cite these test results as evidence that formaldehyde vapor levels in UFFI-insulated homes do not exceed those in the air of non-UFFI buildings or in ambient outside air in Massachusetts.

Opponents' ambient air tests present only a small sampling of formaldehyde readings and cannot be used to predict the amount of formaldehyde commonly present in ambient air in Massachusetts. On the contrary opponents' evidence corroborates other evidence showing that there is no quantifiable amount of formaldehyde characteristically present in ambient air, and that the amount of formaldehyde in air will vary from time to time and place to place. For example, EPA reports that a 1961 study of formaldehyde levels in Los Angeles air showed a daily increase in formaldehyde concentrations from .04 ppm to .05 ppm between 7 a.m. and 11 a.m. An urban Toronto study showed similar concentration gradients. A 1969 study of formaldehyde levels in Huntington Park, California correlated higher readings in late morning with rush hour traffic. EPA concluded based on this data that: "Daily and hourly fluctuations are evident from the date presented in Tables 34 and 35. However, sufficient information is not available to determine the long term trends in atmospheric formaldehyde concentrations." O. Ex. 9(u) at pp. 94-98.

The evidence before us indicates that no particular level of formaldehyde is commonly present in ambient air in Massachusetts.

Similarly, opponents' test of a small sampling of non-UFFI homes provides an insufficient basis for coming to any conclusion about formaldehyde levels in the absence of UFFI. As with outdoor levels, the evidence indicates that formaldehyde readings indoors will vary with weather conditions, contents of the home, and other factors not controlled in opponents' tests. We therefore are unable to draw any conclusions from these results.

(3) "Thermally efficient house" effect.

The formaldehyde industry and others cite a "thermally efficient house" effect as the cause of chemical vapor build-up in UFFI homes. See, e.g., P. Ex. 60(b); O. Ex. 138. The tightening of the home by the insulation, it is argued, traps vapors produced by other products, resulting in the symptoms reported by proponents.

A Danish test investigating sources of indoor irritation in newly-constructed buildings was submitted in support of this theory. The Danish researcher has conducted laboratory experiments and field measurements on indoor air pollution due to formaldehyde from particle board. These measurements were initiated because of complaints from people inhabiting modern dwellings. Although formaldehyde was found to be the "mean reason" for the complaints, people also suffered symptoms in absence of detectible levels of formaldehyde. As a result, the researcher studied the causes of these non-formaldehyde-induced complaints, and found that other vapors, most notably hydrocarbons, were present in the ambient air in new buildings. He hypothesized that the irritation complained of was caused by these vapors, but concluded that this hypothesis needed further proof. O. Ex. 151.

The Danish study suggests that air contaminants may irritate occupants of new buildings in the absence of formaldehyde, but study results remain inconclusive according to its author. Because the tests concerned new buildings only, they do not indicate whether air contaminants have an equivalent potential for irritation in older, existing structures.

Both proponents and opponents also reported that any energy conservation measures that tighten a home will reduce the natural ventilation that once diluted vapors inside the building. See, e.g., P. Ex. 28. No evidence has been submitted, however, indicating that the installation of other forms of insulation has resulted in the onset of the kind of symptoms experienced after installation of UFFI.[12]

Even were we to conclude that UFF insulation has the capacity to trap existing air contaminants inside houses, however, this would not end our inquiry. We must still consider whether vapors issuing from the insulation itself are trapped by UFFI. The opponents have proferred no persuasive evidence that the chemical vapors trapped in UFFI houses are in fact emitted only from sources other than UFFI or that UFFI is not a major contributor to the gas build-up. Most of the evidence suggests, rather, that UFFI emits formaldehyde vapor and that formaldehyde from UFFI is the gas that the insulation is trapping. The thermal efficiency of the insulation may in fact exacerbate the danger posed by the vapor released from the insulation itself.

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12 A post-hearing submission by William Egnor, filed May 18, 1979, discusses carbon monoxide (CO) levels in kitchens and homes with gas cookers. This study found that elevated CO levels may occur even with non-defective gas stoves. According to the study high CO levels may contribute to respiratory disease, and have caused respiratory problems, particularly in children. Study authors state that their review of pollution in homes has shown consistently high levels of every kind of pollutant and that buildings tend to entrap pollutants. The tightening of homes to conserve fuel energy has decreased ventilation and may have contributed to gas build-up according to study authors.

C. Overall Conclusions Concerning Causation.

Opponents have been unable to rebut the inference that UFFI caused the health symptoms suffered by proponents. Therefore, I conclude that UFFI is the cause of the symptoms experienced by consumers. This is true regardless of whether UFFI is the sole source of the formaldehyde causing the adverse symptoms or whether UFFI is materially contributing to the formaldehyde already existing in the home such that upon its contribution, symptoms appear.

I conclude that UFFI has the capacity to produce personal injury or illness to humans through inhalation or absorption through body surfaces. I conclude that UFFI will induce a local inflammatory reaction on immediate, prolonged or repeated contact with normal living tissue. UFFI is therefore toxic and an irritant. These two findings are separate and independent.

I find that UFFI is customarily used inside the walls of residential and other buildings where individuals will be regularly and repeatedly in close proximity. I conclude that UFFI may cause substantial personal injury or substantial illness as a proximate result of customary or reasonably foreseeable use, and that UFFI is therefore a hazardous substance.

VII. Characterization of the Frequency of Occurrence of Adverse Health Effects Due to UFFI.

The frequency with which UFFI causes adverse health effects can be determined by comparing the number of people affected with the number of homes insulated with UFFI. This section reviews these two factors and states the permissible conclusions concerning the frequency of occurrence of adverse health effects due to UFFI.

A. Number of People Whose Health is Adversely Affected by UFFI.

Consumer testimony, outlined in Section II, indicates that substantial numbers of people are adversely affected by UFFI. Not including visiting friends and business people, over 50 members of the immediate families of those testifying reasonably appear to be suffering from symptoms caused by UFFI.

The Executive Office of Consumer Affairs (EOCA) reported that, in its experience, many more people are adversely affected by UFFI. EOCA has been reviewing consumers experience with UFFI and has received both inquiries and complaints concerning UFFI. EOCA acted as an intermediary with respect to many consumer complaints between the consumer and the industry. According to EOCA's report, more UFFI consumers than those appearing at the public hearing have complained of adverse effects from UFFI. While there is no way to determine definitively how many additional people have been affected, EOCA's experience with consumer complaints indicates that injury due to UFFI may be occurring in more instances than those reported directly by consumers at the public hearing.[13]

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[13] EOCA logged 519 telephone calls concerning UFFI, 161 of which constituted "enquiries" (5 of which were from installers of UFFI) and 358 of which were "complaints." EOCA gathered questionnaires from some of the individuals who called. P. Ex. 64. In general, we agree with the testimony of Nicholas J. Tortello (O. Ex. 39) and Lawrence G. Branch (O. Ex. 43) that the questionnaires were not adequate polling tools. We therefore do not conclude that the 358 "complaints" present proof that these 358 consumers have been adversely affected by UFFI.

B. Number of UFFI Installations in Massachusetts.

1. Discussion.

In the summer of 1978, UFFI industry representatives estimated that 50,000 Massachusetts homes had been insulated with UFFI. (See letter of November 16, 1978 from Kinloch and Buxbaum to industry members.)

At the time of public hearings, NAUFLM President William Egnor estimated that 10,692 Massachusetts homes have been insulated by foam manufactured by NAUFLM members and by Borden. The NAUFLM members included in that statistic are Celcius, Rapco, Aerolite, C.P. Chemical, Schaum-Chem (Scientific Applications, Dyna-Foam, Brake Enterprises, and BASF). This figure does not include those homes insulated by non-NAUFLM members (e.g., Comfort Foam). O. Ex. 34. The President of New England Aerolite cites 11,000 installations as "industry's best estimate" of total UFFI sales in Massachusetts. T. 321.

These figures are not derived from computations of actual sales of Massachusetts home-owners. Because manufacturers sell component ingredients to distributors or installers for actual sale to customers, some state that they must estimate the number of sales made from the amount of resin sold to Massachusetts suppliers. O. Ex. 34. Other manufacturers reported knowing with precision the number of UFFI installations using their product. For example, Borden's reported 1,022 installations "during last two years" based upon review of homeowner certificates and warranties. Borden submitted a list of dates on which these installations occurred, but did not supply a list of names or addresses associated with those installations. (See letter of September 27, 1978, Mr. DeHart to Mr. Buxbaum.) For the six months preceding this period Borden reported an additional estimated 216 installations. This latter number was an estimate because of inadequacy of contractor records for that period. Similarly, UF Foam Supply of New England (exclusive distributor for Schaum-Chem Ltd) reported that it supplied a "complete

list of installations." That list was comprised of 24 names and addresses. (See letters of November 24, 1978 and September 19, 1976, Mr. Hermanson to Mr. Buxbaum.)

Neither NAUFIM nor individual UFFI manufacturers have described how manufacturers are able to determine the number of sales made based on the amount of resin supplied. Two documents submitted by Celcius permit us to guess at the method used by that company in determining the number of sales made. Celcius reports the sale of 4,243 drums of resin in Massachusetts. O. Ex. 136(a). These sales were made to Thermal Acoustics, a Massachusetts corporation, which in turn distributed the resin to individual, independent dealers in Massachusetts and other New England states. The dealers then sold the foam directly to consumers. O. Ex. 115(c).

Celcius states that 4,243 55-gallon drums insulated 4,000 homes.[14] Using these figures, it appears that each installation required 58.34 gallons of resin according to Celcius' calculus (233,365 total gallons sold divided by 4,000 estimated sales). We do not know how this calculus was derived.

Other manufacturers simply reported their estimates without stating the factual foundation on which they rested (e.g., C.P. cited "available information at C.P." O. Supp. Ex. 130, at p. 8); Aerolite relied on "generally accepted foam coverage date" (O. Supp. Ex. 120)).

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[14] Celcius reports that these 4,243 resin drums were all in fact "used." O. Ex. 136(a). We do not know how Celcius determined whether all of these resin drums were used to install UFFI in Massachusetts homes, or how Celcius determined how much resin was used in individual homes, given the variety of house sizes and the fact that insulation of any given home may be partial or complete depending on whether the home has any other insulation, as well as on other factors deemed relevant by the UFFI buyer.

Because opponents did not provide the factual foundation for these estimates, it is not possible to assess their reliability. This is particularly problematic as the figures provided are in serious conflict. For example, on November 27, 1978 Aerolite claimed that Aerolite Foam was installed in 200-500 Massachusetts homes, Aerolite dealers reporting 200 installations, while the company itself estimated more than 500 Massachusetts installations (letter from Mark F. Clark to Kinloch and Buxbaum, dated November 27, 1978). When Aerolite submitted its customer lists in September, 1978, 173 names appeared (letter from Charles Campbell to Gail Sullivan, dated September 26, 1978). No further lists have been received. When the President of New England Aerolite wrote to the Commissioner of Public Health on August 3, 1979, he claimed "over 1,000 Aerolite installations in the state."

This final post-hearing claim is more than 5 times the number appearing in customer lists. It is double the largest November 1978 estimate, while the largest November estimate is itself more than twice the dealer report. It is unlikely that the post-hearing figure reflects dramatic increases in sales in the last 9 months; New England Aerolite's President reported in March, 1979 that his company's sales were off 80% since November of 1978. T. 328-9.

The numbers reported by insulation contractors are similarly problematic. The total number of installations reported by the insulation contractors who testified was approximately 1,520.[15] The figures quoted by contractors, however, do not always conform with the customer lists also submitted. For example, Mr. MacAleese stated that Cape Cod Gas Company has insulated 500 homes in the last 2 years. O. Ex. 1. The customer list submitted from his company, by contrast, totalled approximately 350. O. Ex. 55. Similarly, the Rapco Dealers Association takes credit for 1,500 installations in Massachusetts. (T. 2-362); customer lists

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[15] This number did not purport to reflect the total number of installations by contractors in Massachusetts.

bearing the "Rapco Foamers" title or otherwise reflecting Rapco sales total less than 600. O. Ex. 55. Even assuming that all of the customers listed in O. Ex. 55 were purchasers of Rapco Foam, the total reaches 728, or less than 1/2 of the number claimed. Mr. French stated that 500 homes in Massachusetts have been insulated by his company, Foam.N.Insulation. T. 2-152. Nonetheless, he submitted just 232 contracts reflecting his company's sales. O. Ex. 32.

2. Conclusion Concerning Number of Massachusetts Installations.

A number of considerations contribute to continued uncertainty as to the number of UFFI insulated homes in Massachusetts. We do not have sales estimates from Dyna-Foam, Breke, BASF. Because of this, and because there are discrepancies in the figures we do have, we cannot determine whether the number of UFFI installations reported by individual manufacturers agree with the NAUFIM estimate of total Massachusetts sales. On a more fundamental level, opponents themselves are uncertain whether their estimates truly reflect the number of UFFI homes; many estimates rely on resin sales and not on actual computations of UFFI homes in Massachusetts. We have not been provided sufficient information to assess the reliability of this method of measuring total homes insulated with UFFI. On the whole, we cannot verify industry estimates because we lack the factual basis on which company personnel relied in making those estimates.

DPH has requested complete customer lists from UFFI manufacturers, distributors and installers. To date, including both pre-hearing and post-hearing submissions, we have received 1,226 names. (These lists have not been checked for duplication of names.) The huge difference between industry estimates of the number of installations and actual lists of installations suggests that there are many fewer than the estimated 11,000 UFFI installations in Massachusetts. Based on the above, I find that in all likelihood the industry estimate of 11,000 installations in Massachusetts is highly inflated.

C. Conclusion Concerning Frequency of Health Effects.

Knowledge of the precise numbers of people affected by UFFI would not allow me to determine the frequency of the occurrence problems caused by UFFI unless I also knew the number of installations of UFFI in Massachusetts. As appears above, I have no reliable estimate of that number. The Commonwealth has attempted to secure complete lists of Massachusetts installations of UFFI without success. The lists submitted to the Commonwealth comprise a small fraction of the number of installations claimed by the industry. The absence of a reasonably complete list has thwarted the Commonwealth's attempts to perform an epidemiological study. See testimony of Dr. Landrigan, T. 78, 79. As a result, judgments must be made upon available information. I do not know the precise numbers of injured people in Massachusetts, but the majority of consumers testifying at the hearing, a substantial number in and of itself, have symptoms caused by formaldehyde exposure caused or significantly contributed to by UFFI. In all likelihood, substantial numbers of other people are similarly affected.

VIII. Alternatives to a Ban of UFFI.

Opponents have argued that a ban is not necessary for three reasons:

A. Any problems posed by UFFI can be remedied individually by the industry.

B. The cause of vapor emission is improper installation; therefore licensing of installation contractors will eliminate the problem.

C. UFFI can be adequately labelled to protect the public from adverse health effects.

These arguments are discussed below.

A. Remedies for Individual Consumers.

This discussion of the industry's remedies for formaldehyde emission will include three topics:

1. Remedies proposed by the UFFI industry.

2. Observations by non-industry people other than consumers concerning the efficacy of remedies proposed by industry.

3. Consumer experience with remedies proposed by the UFFI industry.

1. Remedies Proposed by the UFFI Industry.

Relatively little information has been presented concerning remedies for formaldehyde emissions. The major document recounting the remedies available is O. Ex. 37, submitted by William Egnor, president of NAUFIM. While other documents describe remedies as well (see e.g., O. Ex. 9(c)), the exhibit submitted by Mr. Egnor is more complete and includes all of the remedies that the industry believes will reduce or eliminate formaldehyde vapor from homes insulated with UFFI.

Exhibit 37 describes the following remedies:

1. Ventilation, including an air purge throughout the house, attic ventilation and sidewall ventilation.

2. Chemical means, including:

   (a) ammonia placed out in dishes, sprayed into affected areas, or used in compressed form as a fumigant in a closed house;

   (b) urea solutions sprayed on where foam has been removed, or "wiped onto walls with foam in cavities";

   (c) Polyocupler FFN (formaldehyde fume neutralent),[16] which reacts chemically with free formaldehyde and absorbs it;

   (d) Bad air sponge (stearic acid and a resin gas mixed with activated charcoal)[17] which absorbs and neutralizes free formaldehyde;

   (e) Formaldehyde stopper, a solution applied like paint;

   (f) Purafil, a product which passes air over a bed containing activated alumina treated with potassium permagenate.

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[16] Also included in Exhibit No. 37 is a material safety data sheet, required by the U.S. Department of Labor Safety and Health Regulations for ship repairing, ship building and ship breaking. This sheet describes polycoupler FFN as a hazardous mixture. A solution of this substance will cause burns to eyes and is irritating to skin; the vapor is irritating only at elevated temperatures (180°F+). The document recommends that people "avoid breathing diluted, sprayed or fogged" polycoupler. This is the only information we have been given concerning potential health hazards posed by the remedies.

[17] Also enclosed in Exhibit 37 are three documents produced by a manufacturer of activated charcoal, advertising the effectiveness of activated charcoal in removing such air contaminants as formaldehyde. These documents state that the activated carbon produced by that company is effective in removing formaldehyde as an air contaminant. They describe formaldehyde as a contaminant that is hard to control and requires special absorbents.

3. Mechanical means, including:

   (a) a mechanical air scrubber, employing an adsorption and a chemical reaction as well as a mechanical means of moving air;

   (b) a dehumidifier which removes formaldehyde which may be found in water vapor in the air.

4. Vapor barriers, such as impermeable paint, polyethylene plastics or vinyl wallpaper which serve as mediums of control to reduce the rate and volume of flow.

5. Physical removal of the foam from the walls and cavities of the house.

Opponents submitted no scientific tests showing whether any of these remedies are effective.[18]

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18 A post-hearing submission dated April 25, 1979, and filed September 6, 1979 by letter from Attorney Clark to Commissioner Alfred L. Frechette, describes research done by Actus Environmental Services, Inc. concerning "The Use of Ammonia to Reduce the Concentration of Formaldehyde Residual." This research does little to add to our knowledge of effective cures for formaldehyde emissions from UFFI for several reasons. These researchers studied the impact of ammonia on formaldehyde by soaking a carpet with liquid ammonia and measuring the reduction in its formaldehyde content. Because this procedure lowered the carpets formaldehyde content, they recommend soaking formaldehyde-bearing household products with ammonia and then drycleaning them to reduce (but not eliminate) residual formaldehyde.

UFFI is not a product susceptible of such treatment. The study does not test or discuss other uses of ammonia. It is important to note that researchers caution that ammonia itself is corrosive and irritating and may be hazardous.

2. Observations by Non-Industry People Concerning the Effectiveness of Remedies Proposed by Industry.

A number of people who have been involved in investigating or researching UFFI issues commented on the efficacy of the remedies proposed by the industry to avoid or eliminate formaldehyde problems with UFFI.

Dr. Rumack states that the most obvious remedy is removal of the foam, but notes that this may be difficult and costly and has failed, in some instances, to alleviate symptoms. He also states that the efficacy of chemical treatments has not been demonstrated and warns that certain chemicals (masking agents) may reduce the odor without diminishing the toxicity of formaldehyde. P. Ex. 60(b).

Mr. Charles Bowser, energy conservation specialist for the Massachusetts Office of Energy Resources, stated that he was not sure that simply removing foam from a home will abate the conditions. He reported that he had been in at least two homes from which the foam was removed and found no abatement of the odor whatsoever. He reported that the material seems to be absorbed into the wood structure and it was his guess that outgassing then continued. He could not explain why this happens. (Mr. Bowser adds however that his office would not "independently" ask for a ban of UFFI). T. 2-6.

The Wisconsin Department of Health and Social Services reports in its Epidemiology Bulletin that: "While ventilation may be the best alternative for reducing the levels of formaldehyde in a home, it is not very feasible in cold climates. Keeping windows open can become very expensive in terms of energy costs. The only apparent alternative is removing the insulation or particle board or moving to a different home. Air samples taken in homes before and after wood sealing treatment and ammonia treatments suggested that such treatments have an insignificant effect on reducing levels of formaldehyde." P. Ex. 28 at p. 28.

In a USDA Forest Service study entitled "The Formaldehyde Problem in Wood-Based Products, An Annotated Bibliography", 1977, F.H. Max Nestler, it was observed that "there is a notable lack of quantitative information that permits an effective, solution at the end of time — i.e., after the material has been installed and found to be actively emitting formaldehyde at unacceptable rates." Although the products considered in this study were different (i.e. wood based products), the problem, the emission of formaldehyde foam urea-formaldehyde-type adhesives, is the same.

3. Consumer Experience With Proposed Remedies.

Information concerning the actual use of various remedies in Massachusetts homes comes from industry reports and consumer testimony. The industry reports are found in Opponents Exhibits 33-35:

(a) Exhibit 35 is a report from the National Association of Urea-Foam Insulation Manufactures (NAUFIM) by Charles A. Campbell, Chairman, Task Force Group, dated November 17, 1978. This document provides a status report on 34 complaints reviewed by NAUFIM.

(b) Exhibit 34 is a report from William Egnor, President of NAUFIM, dated March 20, 1979. This report reviews four cases, 3 of which were previously reviewed by Mr. Campbell and reported in Exhibit 35.

(c) Exhibit 33 is a statement by Mr. Egnor dated March 30, 1979. In this statement Mr. Egnor reviews the work of the Task Force with respect to the 34 complaints previously reported upon by Mr. Campbell on November 17, 1978. It also characterizes the Task Force's mission and the nature of the 34 complaints which were the subject matter of the November 17, 1978 report.

Mr. Egnor states in Exhibit 33 that the 34 complaints were the most serious complaints known to state. State personnel report on the contrary that these were the complaints of those consumers who consented to have the state disclose their names to the industry for resolution of their problems. See letter of November 16, 1978 from David Kinloch, M.D., DPH, and Lawrence Buxbaum, EOCA, to industry members generally.

Mr. Egnor speaks of the Task Force's efforts "to deal with the complaints." Other exhibits elaborate the purpose of the NAUFIM Task Force with greater specificity. On October 23, 1978, Mr. Warren Heinz wrote to Mr. Charles Campbell, Chairman, Task Force Group, NAUFIM, complaining of odor, medical and cost problems associated with the installation of UFFI in his home. By letter dated November 22, 1978, Mr. Campbell responded, noting that "the task force group of NAUFIM was set up to resolve odor complaints and odor complaints only." (This letter was submitted to DPH before the March public hearing.)

As appears below, NAUFIM refers to "odor problems" and does not discuss having solved health problems in the November 17, 1978 report, Exhibit 35. It is highly likely therefore that these reports offer incomplete information concerning whether the attempted remedy was successful in eliminating non-odor problems such as health complaints.

The consumers' experience with remedies, as described in Opponents' Exhibits 33-35 and consumer testimony, is summarized below. Section A describes consumer experience which is reported by NAUFIM, but for which there was no consumer testimony. Section B describes consumer experience which was reported by NAUFIM and also by the consumer in his or her testimony. Section C describes consumer experience which was reported by the consumer only.

(a) Consumer Experience As Reported by NAUFIM, For Which There Was No Consumer Testimony.

1. Mr. Campbell reports in Exhibit 35 that polycoupler was applied to the walls in the home of Norman Phinney. He states that a conversation in early November "indicates consumer no longer has an odor problem." We have no further information on Mr. Phinney.
2. Mr. Campbell reports that ventilation and dishes of ammonia in each room with the heat turned up eliminated the odors in the home of R. Mills. Mr. Mills told NAUFIM he was still concerned about exposure to low levels for long periods of time. We have no further information about Mr. Mills.
3. NAUFIM removed the foam that had extruded out the bottom of the cavity into the crawl space under the house during application in the home of S. Ferency. Mr. Campbell reports "no odor problems have been reported since." We have no further information about this home.

4. Mr. Campbell reports that the panelling in the entryway of the home of P. Cooper was taken down, a plastic vapor barrier installed and the panelling replaced. We have no further information about this home.

5. The home of R. Larsen was treated with ammonia fumigation and mechanical air-scrubbing. Mr. Campbell states "no complaint as of November 3, 1978." We know nothing further about this home.

6. Dishes of ammonia were placed in the storage area of the home of H. Remon, and a mechanical air-scrubber, ventilation in the ceilings, and a plastic vapor barrier over exposed holes in the storage area were used. We have no further information about the effectiveness of these remedies.

7. Mr. Egnor reports that motorized dampers were in the process of being installed in the Getter house in November of 1978. The principal officer of C.P. Chemical Company reports that he has been advised that the problem no longer exists. O. Ex. 130.

8. Exhibit 34 reports that ten inches of insulation were removed from the upstairs floor area and a small amount of ammonia sprayed in the DeCoursey home. Polycoupler was also used and the house was ventilated. Mr. Egnor reports that there is still a strong perceptible odor which seems to be coming from the insulation but it is his "feeling" that this odor is not formaldehyde. He suggests that removal may be necessary. We know nothing further about this house.

(b) Consumer Experience Which Was Reported By NAUFTM and By The Consumer In His or Her Testimony.

1. As of early November, 1978, Mr. Campbell reported that the Duddy household had been equipped with a mechanical air-scrubber. He does not update this report in any of the other exhibits.

Mrs. Duddy testified that her home was vented by drilling holes in the exterior of the house in January of 1979 but that now when the wind is strong the odor is blown inside the house. She did not state that mechanical air-scrubbers were used. The problems persisted after these remedies were tried. T. 2-15.

2. The exposed foam in the home of Mr. Léger was removed and the house treated with ammonia twice according to Mr. Campbell. The insulation was replaced with fiberglass and covered with plastic.

Mr. Leger reported at the hearing, however, that a formaldehyde neutralizer in the form of an airwick was first installed, but did little good in relieving his family of their health symptoms. Polycoupler was recommended by the installer, but the Office of Consumer Affairs could not recommend use of that product. Problems persisted after partial removal. T. 2-38 to 42.

3. In the house of W. Heinz, the foam was removed and the consumer said that he could not detect any further odor according to Mr. Campbell.

Mr. Heinz testified that, on the contrary, he and his family continued to have very serious health problems even though the foam has been removed from the garage ceiling and the den floor. Mr. Heinz testified that he was assured that vapor barriers would be installed in the bedroom but nothing had been done as of March, 1979. T. 144-145. Mr. Heinz himself installed a large fan in the den which he keeps running all day. T. 146. He was still dissatisfied as of the date of the public hearing.

4. In the Mcclew home, Mr. Campbell reports that vent holes were drilled and plugs installed, that polycoupler, bad air sponges and mechanical air scrubber were used, and that the foam was removed from a ceiling area in the back porch. As of November, 1978, arrangements were reportedly being made to have the foam removed from the walls in the kitchen and the porch.

As of the date of the public hearings, however, the McGlews remained unsatisfied.

Robert and Marjorie McGlew reported that they and their children experienced serious health problems after the holes were drilled, and the polycoupler, air-scrubber and bad air sponges installed. See T. 125 et seq.

5. In the Barth home, Mr. Campbell reports that vent holes with plugs, polycoupler, and complete cleaning of inside floors, walls, trim, furniture, and all beddings were carried out by NAUFLM.

The Barths reported at the public hearing, however, that first the walls were sealed with paint, and bad air sponges in five pound blocks were placed all over the house. This reportedly "helped a little." Vinyl wallpaper was also used. T. 24. Most of the foam was removed from the home by the consumer and the studs treated with ammonia. T. 32; O. Exs. 33 - 34. Mr. Egnor stated that in March, 1979, further remedial action was necessary to take care of a "minor odor problem" in the upstairs section of the house. He recommended ventilation and an ammonia treatment.

6. The foam was removed from the St. Pierre garage ceiling in July of 1978 according to Mr. Campbell. Two thermostatically controlled power vents were installed in July of 1978. The inside of the house was cleaned on August of 1978. In October, polycoupler was sprayed on the house walls.. Mr. Egnor proposed in November, 1978 that the carpet be treated to remove any formaldehyde.

Mr. St. Pierre reported at the public hearing, however, that exhaust fans were installed in both his attics, several applications of polycoupler were made and windows were left opened continuously, but none of these remedies worked. If anything, he described the situation as having worsened. T. 161-162. After he retained legal counsel, it was agreed that the foam would be removed from the garage area, which at the time seemed the worst area. Although this was done, the odor still remained as of the date of the public hearing to such an extent, according to Mr. St. Pierre, that it was impossible to stand in the garage without experiencing health symptoms. Since removal from the garage, Mr. St. Pierre stated that the installer and manufacturer made no further recommendations to alleviate the problem. T. 162-163.

7. The foam was completely removed in the Kelly home. The Kellys' reported satisfaction with this remedy at the public hearing.

8. The foam was removed from the Pereiras' home. The Pererias report that some of the foam stuck to the wood and the foam was not removed from above windows; after removal symptoms decreased but their son's eyes were still affected.

9. NAUFIM reported that the attic foam was removed from the Oswiak home but the boards and ceiling drywall had not been cleaned of residual foam particles as of November, 1978. NAUFIM believed that these particles must be cleaned and the ceiling drywall treated with ammonia to eliminate any further occurrence of odor. NAUFIM stated that the Oswiaks refused any further remedies in the attic, insisting on removal of foam from the sidewalls. In NAUFIM's opinion, the sidewall foam was not contributing to the problem.

The Oswiaks testified that they had been told to spread coffee grounds in their attic and put vent holes in the attic, but these did not alleviate their problems. Opening windows did help but conditions worsened when the windows were closed. The industry recommended using ammonia and shellac, and finally recommended removal of the foam.

(c) Consumer Experience Which Was Reported By The Consumer Only.

1. The Smiths used charcoal air scrubbers without any reported success. They declined to use ammonia bath. Conditions improved after the foam was removed from their attic.
2. The Cornwells testified that their son's problems went away when foam was removed from a portion of the house.
3. The Boyers report that the problems went away when the windows were open. They have since abandoned their home.
4. The Coles testified that air purifiers did not alleviate their problems.
5. Mr. Rowley testified that the fumes subsided after the insulated room was painted.

6. The Ryans testified that the UFFI industry sent to them an air-wick and an air purifier with a charcoal filter, but that the filter had not been changed and that the problem got worse.

7. A "neutralizing" substance was applied in the Butler home by the installer without any apparent success.

4. Conclusions Concerning Remedies.

The remedies proposed by the industry have not been scientifically studied to determine their effectivensss. Industry descriptions of the effectiveness of remedies in individual cases are generally not helpful in the absence of corresponding consumer testimony. As indicated above, it is doubtful that NAUFIM was reviewing the effectiveness of remedies in resolving consumers' health related complaints. Additionally, follow-up information is generally unavailable.

Even if we assume that all remedies were successfully used in those cases reported by NAUFIM, it would still appear from consumer testimony that these remedies fail in a majority of cases.

Consumer testimony overwhelmingly indicates that the remedies attempted by the industry, or by the consumers themselves, do not work. The single notable exception is removal of the foam. Even with removal, some of the consumers report that removal did not stop their problems, or that they suffered from residual problems.

This failure of these remedies in Massachusetts homes is consistent with the observations of non-consumers that the efficacy of the proposed remedies has not been demonstrated.

B. Licensure of Installers and Regulation of Installation Standards.

(1) Discussion

The installer plays a unique role in UFFI production. Because the final UFFI insulation product does not exist at the moment the installer arrives at the consumer's home, the installer must "manufacture" the insulation on-site from component ingredients as it is installed. The insulation does not actually exist in final form until it is inside the walls of the consumers' home.

In this context, opponents cited faulty installation as the major cause of vapor release and urged licensure of installers and/or standards for installation as a method of vapor control. See, e.g., O. Exs. 9(c), 9(i), 9(r); T. 2-247, T. 2-239, T. 322. Numerous witnesses cited factors which, if properly controlled by a knowledgeable installer, they believed would result in little, if any, formaldehyde vapor emission. Factors cited include:

(a) ventilation characteristics of the home (Dr. Firstmen; Rapco);

(b) condition of the foam (Dr. Firstman; Mr. Hayes);

(c) flow rate (Dr. Firstman);

(d) frequency with which the foam is monitored during application (Dr. Firstman);

(e) temperature and humidity at which the chemicals are mixed (Dr. Firstman; CPSC; Mr. Christopher);

(f) freshness and proportions of the chemicals (Mr. Hayes; Rapco; CPSC; Mr. Pratt; Mr. Christopher);

(g) foam density (Mr. Hayes; Rapco, CPSC);

(h) gel time and cell size (Mr. Hayes);

(i) any conditions which prevent exterior venting of the excess formaldehyde into the outside air, such as vapor barriers or holes in the interior wall (Mr. Hayes; CPSC);

(j) application in ceilings with vapor barriers, in air plenums, attics, open cavities, or in the path of an air stream (Rapco);

(k) free formaldehyde content of the resin (DOE, CPSC; Alan Bowles);

(l) whether resin is in liquid or powder form (Mr. Pratt);

(m) storage conditions of the ingredients (Mr. French).

Opponents have submitted standards and specifications promulgated by manufacturers and/or regulating agencies, setting forth procedures for proper foam installation. See, e.g., O. Ex. 22-23 describing standards required by the British Standards Institute. Canadian installation and foam content standards (O. Exs. 26(e)(f)) have been incorporated into regulations proposed by the U.S. Department of Energy (O. Ex. 9(i)). HUD has published a bulletin stating that UFFI is accepted for use in HUD housing programs if the specifications of the bulletin are followed. (O. Ex. 9(d)).

Alan M. Bowles of the Canadian Government Specifications Board (CGSB) reported that CGSB has promulgated standards for the installation and content of UFFI. He believes that, if these criteria are followed UFFI will not pose a health hazard. He did not state his basis for this conclusion. O. Ex. 26(b).

Robert G. Elliott, General Manager of Rapco Foam Division of Lorcon, Inc. of Canada, stated that in his experience UFFI has been used successfully in Canada without any adverse health effects. O. Ex. 26(a).

Some installers argued that their customers had not experienced odors or adverse health effects, an that this suggested that proper installation would avert any danger. See, e.g., O. Ex. 56.

Proponents' witnesses suggested, on the other hand, that the installation

protocols developed by manufactures would not necessarily control vapor release. Installer Chapdelaine, for example, testified that he was trained and precisely followed instructions on installing the material but that, after problems arose in homes of two of his customers, he stopped using UFFI and does not feel that it is safe to offer UFFI to the public. T. 2-94, 95.

Exhibits submitted by manufacturers indicate that UFFI requires a complicated, possibly prohibitively complex, installation and manufacturing procedure. See, e.g., O. Ex. 28. The installation process is elaborate and requires often exquisite attention to detail. For example the temperature outside the home, the temperature inside the home, the temperature inside the wall cavities of the home (including the temperature of the outside wall as contrasted with the inside wall) and the temperature of the foam ingredients are all relevant. No two homes present identical settings for foam manufacture and installation.

Opponents presented no scientific studies documenting how, or whether, installation procedures can be properly performed in most instances. We also lack evidence showing how or why the industry has become convinced that poor installation must necessarily account for vapor release. Most witnesses listed factors they believed would contribute to formaldehyde emission, but did not document the way(s) in which failure to control any or all of the factors would result in vapor release, or how or why particular installation protocols would eliminate the vapor problem.

Government standards (DOE, Canadian, HUD) regulate installation practices, but do not state specifically which regulations are intended to control vapor emission or how the standard adopted will result in formaldehyde vapor control.

This lack of information is particularly troubling in light of the fact

that experts disagree as to how vapor emission might best be controlled at the point of installation. For example, the government regulation apparently most directly on point is the HUD, DOE, ASTM and Canadian limit on the amount of formaldehyde in the resin. All four limit the formaldehyde content of the resin to 1%. Some industry experts do not believe that this regulation will control emission, however. Dr. Firstman states that this factor has only a small bearing on total formaldehyde vapor emission, insisting that chemical mixing conditions are far more important. T. 262, 265. Mr. Pratt of CIBA-GZIGY in the United Kingdom agrees that the amount of formaldehyde released does not necessarily bear a direct relationship to the free formaldehyde in the resin. O. Ex. 25. The National Bureau of Standards, on the other hand, joins the other federal agencies in recommending control of free formaldehyde content of the resin as a method of keeping formaldehyde emission to a minimum. O. Ex. 9(c).

NAUFIM recommends that DOE require each manufacturer to insure that the resin contains 1% or less of aldehydes. NAUFIM states further, however, that it makes no guarantee of the results and assumes no liability or responsibility in connection with the suggestions it tenders. O. Ex. 119.

Another factor reportedly relevant to formaldehyde emissions is the portion of the home insulated. Different manufacturers make different claims for their respective products on this issue. For example, most manufacturers prohibit installation in attics on account of vapor problems; Bruce Christopher of Celcius Resources, on the other hand, claims that his company's product is suitable for attics and will not emit vapors if so installed. P. Ex. 85 at p.53.

(2) Conclusions Concerning Licensure of Installers and Regulation of Installation Standards.

Opponents have claimed that proper installation will eliminate formaldehyde

problems in UFFI homes. Opponents have not substantiated these claims with scientific tests or other evidence, however. Opponents have not demonstrated that UFFI can be installed properly in spite of complex installation protocols and volatile weather conditions. Nor do I have evidence showing precisely what installation procedures will control vapor problems, or whether these procedures have the capacity to eliminate vapor emissions from the insulation.

I therefore cannot conclude that improper installation necessarily accounts for the formaldehyde problems experienced in UFFI-insulated homes. The evidence suggests that improper installation may contribute to vapor release, but does not support a finding that licensure of installers or regulation of installation procedures will eliminate the problems experienced.

C. Labelling

In deciding whether a label can adequately protect the public from dangers posed by UFFI, I have considered whether such a label could inform the consumer of the injury caused by UFFI, whether the label could state the extent of the risk incurred in using UFFI, whether the product is of such a nature that the information in the label can be helpful, and whether a label could in fact reach all those potentially affected.

It is apparent that the type of injury caused by UFFI can reasonably be predicted. A label could state that UFFI emits formaldehyde, and formaldehyde causes respiratory problems, nausea and other symptoms described above.

The label could not describe the extent of the injury associated with UFFI, however. The health impact of 24 hour exposure to low levels of formaldehyde vapor over long periods of time is not known. The exact amount of formaldehyde emitted is unknown and may vary from time to time and place to place.

The label could not state the likelihood or probability of injury. Even those symptoms known to be characteristic of formaldehyde exposure do not occur in a predictable fashion. Whether a particular installation will cause problems cannot be determined until after installation is completed. Likewise, it cannot be predicted whether a given individual will be affected by UFFI. This problem is exacerbated by the fact that some individuals become sensitive or allergic to formaldehyde only after UFFI is installed.

Although a label could be devised that would recount health symptoms typical of formaldehyde poisoning, therefore, no label could meaningfully inform consumers of the likelihood of health damage or the circumstances under which injury could be expected to occur.

Further, once UFFI is installed, a label would be unable to tell consumers how to protect themselves from the risks posed by UFFI. Unlike products that can be disposed of or that can be placed out of the reach of children or used only by those for whom no danger is evident, UFFI cannot be avoided without abandoning the house itself. UFFI once installed becomes indistinguishable from the home. Unlike workplaces, homes are not equipped with protective gear capable of insuring the safety of exposed individuals. We have no reliable evidence showing that the remedies proposed to reduce the health danger attendant on installation of UFFI actually work. Any label purporting to state how formaldehyde vapors can be remedied would suggest greater knowledge than we in fact have.

Finally, because UFFI is not handled or even noticed by visitors to the home, occupants of public buildings and others who may come in contact with formaldehyde vapors, it is not possible to label UFFI in such a way as to notify all those potentially affected by the danger it poses.

These considerations, each independently as well as taken as a whole, lead me to conclude that UFFI cannot be adequately labelled to protect the public health and safety.

IX. Economic Impact of A Ban of UFFI

The industry has argued that the economic effect of the proposed ban should be considered. Although I do not believe that consideration of economic impact is germane in deciding whether a product is a "banned hazardous substance," those considerations are revieved in this section. The first part of this section discusses the potential economic impact of a UFFI ban. The second part reviews the potential impact of keeping UFFI in commerce. The final section draws conclusions from this evidence of economic effects.

A. Impact of Banning UFFI.

1. Impact upon manufacturers.

The urea-resin manufacturing industry argues that a ban in Massachusetts, may cripple their business on a national scale; when coupled with a repurchase requirement some claim they must go bankrupt. See. e.g., O. Exs. 115(a)-(d); 129(c); 131(a). The industry has provided no quantification of this claim.

Other evidence, further, shows that the urea-resin market nationwide encompasses but a few manufacturers whose resins are used in many products other than UFFI. There are an estimated total of 20-25 manufacturers of urea-formaldehyde resins and foaming agents in the United States. Of these, 4 of 5 are major manufacturers; Rapco is the largest in the nation, claiming 70% of all 1977 UFFI installations. O. Ex. 9(r).

These manufacturers market their resins for use in a number of ways. For example, UF foams are used to block seepage of methane gas and to absorb oil spills. Urea-formaldehyde resins are used for a host of other purposes. See O. Exs. 9(r); 9(t). Should UFFI be banned in a single state, or even across the nation, UF producers have not demonstrated that they will lack markets for their urea-resins.

Although the cost of repurchase is substantial, not all UFFI consumers would necessarily opt for repurchase. The extensive interference with the structure of the home required by repurchase may deter many.

2. Impact on distributors and installers.

Available estimates of numbers of distributors and installers are imprecise. As of the November, 1978 CPSC memorandum, distributors numbered in the 100's, installers in the 1,000's nationwide. O. Ex. 9(r).

Individual distributors and installers in Massachusetts stated that they would be driven out of business by a UFFI ban. T. 2-144; T. 179; T. 2-352; T. 2-361 to 363. The contractors who testified described themselves and other Massachusetts insulation contractors as small business people. James McGregor uses family members plus two part-time and two full-time employees. T. 179. Most Rapco dealers are small, one truck, one crew-member firms. T. 2-362. Rapco, the largest UF foam manufacturer in the nation, has utilized just 16 licensed dealers in Massachusetts in the past (including 3 from out-of-state who do some business in Massachusetts). T. 2-361. As of March, 1979, there were just 10 Rapco installers in Massachusetts. T. 2-362.

No information indicates that these installers could not use other forms of insulation in place of UFFI. No information has been provided which quantifies the potential economic impact on installers and distributors. The available evidence indicates that the number of working people in Massachusetts potentially dislocated by a ban is very small.

3. Impact upon the public.

(a) Health cost impact.

Opponents have suggested that other insulation materials may be more injurious to health than UFFI. See, e.g., O. Ex. 106 (cellulose regulated by CPSC to reduce flammability); O. Ex. 9(s) and T. 200-201 (CPSC reviews petition alleging that fibrous glass insulation may be associated with unreasonable risk

of injury from fires and cancer, but finds the available information insufficient to reach such a conclusion.) Opponents argue that there are no insulation products on the market equivalent of UFFI in thermal effectiveness that do not present risk of injury greater than that associated with UFFI.

The claims that other insulation products pose health hazards have not been documented further, however, and remain merely suggestive of the problems alleged.

(b) Energy cost impact.

The opponents also argued that a UFFI ban would interfere with energy conservation and would increase energy costs for consumers. This claim was not documented. Although many of the articles submitted cited home insulation as an important component of energy conservation efforts (see, e.g. O. Exs. 158, 135, 134, 133, 121), none of this evidence clearly demonstrated that a UFFI ban would cause waste of energy resources that could not be compensated by other insulation materials.[19]

One of oppenents' arguments in this regard centers on the thermal efficiency of UFFI. Opponents claim that UFFI has greater effectiveness as an insulation material than other insulation products. There is substantial disagreement concerning the relative effectiveness of UFFI, however. For example, opponents state that UFFI has the highest "R" value, approximately 4.2 per inch. O. Ex. 121, p.10. See also installed shrinkage of Rapco-Foam, Urea Formaldehyde Foam Insulation, submitted to HUD, 7/9/78, reporting average shrinkage of 3.6% in samples from 26 homes. By contrast, the Executive Office of Consumer Affairs reports that the Central Mortgage Housing Corporation (CMHC) accepts 2.5 per inch as the effective R-value for UFF for a standard stud space of 3 1/2", with the understanding that UFF is only installed in older walls which have no existing

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19. The only figures purporting to reflect energy savings directly attributable to UFFI appeared in the testimony of John Mulholland, president of Schaum-Chem, Ltd. Mr. Mulholland claimed that, as of 1975, in the rehab market alone, UFFI could save "up to a million barrels of oil per se." T. 2-343. This figure was not otherwise documented or explained.

insulation. The 2.5 per inch effective R-value accounts for post installation shrinkage and cracking, and reflects the actual performance of UFF in service, according to Fact Sheet No. 3, Standards and Material Acceptances for Urea Formaldehyde, Office of Energy Conservation. (Reported in EOCA's brief, P. Ex. 87, p.24.)

In a June, 1978 study of 80 homes by the Massachusetts Energy Office entitled Massachusetts Study of the Retrofit Insulation Industry, it is reported that blown-in dry materials (i.e. cellulose, loose fiberglass and mineral or rock wool) are the most efficient in insulation quality and that "the installers of urea formaldehyde foam are the group most deserving of regulatory scrutiny. Three of the foam jobs surveyed were of special concern and many evidenced shrinkage of as much as 10%."

B. Impact of Keeping UFFI in Commerce.

The economic impact alleged by the industry must be assessed in light of the economic cost to consumers if a ban is not promulgated. The economic damage reported by those consumers who testified reflects the range of costs incurred by those who suffer formaldehyde-induced health symptoms: many vacated their homes with attendant increases in housing costs; some hired lawyers; others suffered from inability to work; most reported visiting physicians and/or being admitted to the hospital. Absent a ban and provision for repurchase, some consumers will have trouble selling UFFI insulated homes to buyers wary of potential health injury. See, e.g., T. 2-133 to 2-141; 2-28 to 2-35.

The cost of remedies proffered to control formaldehyde emission must also be taken into account. Should UFFI remain on the market, many of these costs would have to be borne by consumers adversely affected by UFFI. I have not been

provided figures showing the cost of most of the recommended remedies. The cost figures I do have, however, are daunting. KAUFFM estimates foam removal costs at $3,000 per home. Consumers who testified reported removal costs considerably higher -- one consumer got an estimate of $19,360. T. 2-55. Another set the cost at $15,000. P. Ex. 52; T. 32. William Egner quoted $6,000 as the cost of painting and wallpapering the interior of the outside wall, a remedy requested by one KAUFFM constomer. O. Ex. 35.

C. Conclusions Concerning Economic Impact of a Ban.

Any employment dislocation caused by a ban of UFFI would be very small. The impact of a ban on urea-resin and foam manufacturers has not been quantified; the evidence we do have indicates that these manufacturers would continue to have markets for their products even if UFFI were banned in Massachusetts. Local installers and distributors of UFFI are few and have not presented evidence that they cannot market other insulation products in lieu of UFFI.

Opponents state that additional energy and health costs would be incurred by a UFFI ban. These claims have not been substantiated.

I am also unable to quantify the impact of keeping UFFI in commerce. The bulk of the evidence suggests, however, that medical, remedial and other expenses would be incurred and that these expenses would have to be borne by UFFI consumers.

The evidence does not show that a ban will cost more than the continued marketing of UFFI. To the extent that a UFFI ban will result in additional costs, the detrimental health effects and economic impact of keeping UFFI in commerce outweighs the economic burden imposed by those costs.

X. Imminent Danger.

The danger posed by UFFI has been recounted above. Adverse health symptoms have been experienced by a substantial number of people in Massachusetts as a result of, or significantly contributed to by, the presence of UFFI in their homes.

This danger will continue to exist until the UFFI is removed from the homes of those who suffer. Additionally, more homes will be insulated with UFFI in the near future. Installations of UFFI are expected to increase dramatically in the next decade. See, for example, O. Ex. 9(r). This will result in further injury to home-dwellers due to formaldehyde exposure from UFFI. Cumulatively, these factors mean that significant numbers of people will continue to be subject to severe injury.

XI. FINDINGS AND DECLARATIONS CONCERNING FORMALDEHYDE AND UFFI

Based on this evidence, I find and declare the following:

UFFI bears and contains formaldehyde. Formaldehyde and UFFI are both toxic substances and irritants which may cause substantial personal injury of substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use. Both formaldehyde and UFFI are therefore hazardous substances. This declaration will promote the objectives of this chapter by avoiding or resolving uncertainty as to its application.

UFFI presents an imminent danger to the public health and safety and cannot be labelled adequately to protect the public health and safety. These two findings constitute separate and independent grounds for banning UFFI.

UFFI is intended for use in households by all household members, including children. The formaldehyde born by UFFI is susceptible of access to children.

Notwithstanding cautionary labelling, the degree and/or nature of the hazard involved in the presence or use of UFFI in households is such that the protection of the public health and safety can be adequately served only by keeping UFFI out of the channels of commerce. The susceptibility of access to a child of the formaldehyde born by UFFI provides a foundation for declaring this substance a banned hazardous substance independent of the other characteristics of this product.

UFFI is therefore declared to be a banned hazardous substance based upon each of the above grounds independently and based upon all of these grounds cumulatively.

Addendum

Recent test results reported by the Chemical Industry Institute of Toxicology indicate that formaldehyde has caused cancer in laboratory animals. These findings were made during the course of an on-going long-term study. As of October 1979, the laboratory animals were in their sixteenth month of what is planned to be a 24 month exposure. The formaldehyde study generally follows a standard CIIT protocol that calls for Fischer 344 rats and B6C3FI mice to be exposed in groups of 120/sex at each of three exposure levels, plus controls, for six hours per day five days per week. Animals of both species are exposed concurrently to the same concentrations of formaldehyde vapor in 5 cu. meter stainless steel and glass chambers. The exposure levels have been verified by infrared spectrophotometric analysis, and found to be within a close range of the designated levels. In the present ongoing chronic study the levels are 15, 6 and 2 ppm. Among the male rats exposed to 15 ppm formaldehyde, 3 cases of squamous cell carcinoma were observed. In each instance, the neoplastic tissues appear to have evolved from the cells lining the upper respiratory tract and to have eroded through the overlying or adjacent turbinate and maxillary bones. To date, squamous cell carcinoma of the nasal cavity has not been seen in the exposed or control mice, nor in 480 control rats in this study.

These results mean that formaldehyde is a potential causative agent of cancer in humans. Prior evidence did not warrant this conclusion (see footnote 10, p.56).

This evidence provides an additional reason why formaldehyde and UFFI are toxic and hazardous and buttresses the findings concerning the danger posed by formaldehyde and UFFI. However, the findings and declarations concerning formaldehyde and UFFI in this Summary and in the final regulations were made without reliance upon the carcinogenic potential of formaldehyde and I do not rely on this study in declaring UFFI a banned hazardous substance.

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April 29, 1983

The Honorable Edward F. Hennessey
Chief Justice
Supreme Judicial Court
for the Commonwealth
1300 Pemberton Square
Boston, Massachusetts 02108

Re: Borden, Inc. v. Commissioner of Public Health, No. 2849

Dear Mr. Chief Justice:

Plaintiff-appellee C. P. Chemical Company, Inc., by its undersigned attorneys and pursuant to Mass. R. App. P. 27, hereby petitions the Court for a rehearing in the above-captioned case. In support of its petition, C. P. Chemical Company states the following:

1. The Court should grant a rehearing in order to assess the implications of the Fifth Circuit's recent decision in Gulf South Insulation v. U. S. Consumer Product Safety Commission, slip op. (5th Cir. April 7, 1983), a copy of which is attached. The court in that case struck down CPSC's rule banning UFFI in residences and schools, holding the agency's record deficient because of its "failure to quantify the risk at the exposure level actually associated with UFFI." Slip op. at 3644. CPSC's finding that UFFI exposure poses an "unreasonable risk" to consumers, the court concluded, was not supported by "'such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.'" Id. at 3638.

The decision in Gulf South, issued just a few days before this Court's opinion, merits consideration for two reasons. First, as noted by Borden and the Institute, the very evidence relied upon by the Commonwealth before this Court was specifically held insufficient to justify a federal ban. The court found fault, for example, with the Oak Ridge Labs tests and the National Academy of Sciences report cited by this Court as affording the Commissioner of Public Health authority to ban UFFI. Although the Fifth Circuit described its standard of review as a "substantial evidence" test, it also held that the record lacked "such relevant evidence as a reasonable mind might accept" as support for the Commissioner's action. In the Fifth Circuit's view, therefore, the record before it, which contained more evidence in favor of a ban than the Commonwealth offered here, would not have satisfied even the very lenient "any conceivable basis" standard of review used by this Court, much less a true "rational basis" test. Because the Fifth Circuit completely and unequivocally rejected the arguments in favor of a ban of UFFI, this Court, too, should reexamine the

factual foundations of the Commissioner's regulations.

In addition, the Fifth Circuit held that CPSC was statutorily bound to proceed under the Federal Hazardous Substances Act rather than under the Consumer Product Safety Act. As discussed below, Mass. G. L. c. 94B, §2 mandates that the Commissioner's regulations "conform, insofar as practicable, with the regulations established pursuant to the [FHSA]." The reversal of the federal ban--properly established only under the FHSA--obviously vitiates any such conformity; the Commonwealth has totally banned an industry that is now unregulated under the federal statute. The Commissioner's regulations, therefore, do not comply with G. L. c. 94B, and must be held invalid.

2. The Court misconstrued Mass. G. L. c. 30A, §1, in holding that the statute did not require the Commissioner to afford plaintiffs an adjudicatory hearing before promulgating the ban regulations challenged in this litigation. Contrary to the Court's decision, plaintiffs were clearly tantamount to "specifically named persons" within the meaning of the statute.

Although the Commissioner purported to be considering regulations of general applicability and future effect only, his ban of UFFI conclusively determined the legal rights of a small, discrete, and readily identifiable group of manufacturers, dealers, and installers, each of whose business depended for its survival upon the continuing legality of the sale and distribution of UFFI in the Commonwealth. Far from simply restricting the circumstances under which these persons could continue to operate their businesses, the ban wholly excluded their industry from Massachusetts, immediately and directly depriving them of their livelihoods. While the regulations were ostensibly directed only toward UFFI in the abstract, it was clear all along that their impact would fall harshly upon a narrowly-defined class of persons. The Commissioner's action, therefore, had all the indicia of an adjudication.

The Court erred in construing c. 30A as nevertheless inapplicable on the ground that the Commissioner had not named specific persons as parties to the hearing. This construction would always allow an agency to avoid the rigors of an adjudicatory hearing, at its unfettered discretion, merely by proceeding nominally against a product, knowing full well that the livelihoods of a readily identifiable group were at stake. It is the practical effect of the regulatory action, however, that identifies "specifically named persons" and triggers the right to an adjudicatory hearing. The Court should reinterpret c. 30A, §1, to mandate an adjudicatory hearing when, as in this case, the agency's action will determine the rights and duties of specific and easily identifiable persons.

Failure to hold an adjudicatory hearing prior to the ban also violated plaintiffs' due process rights under the Massachusetts Declaration of Rights. The right to operate a business or pursue a chosen profession is a liberty and property interest protected by the Declaration. Konstantopoulos v. Town of Whately, 1981 Mass. Adv. Sh. 1669, 424 N.E.2d 210 (1981); Kearney v. Board of Registration, 4 Mass. App. Ct. 25, 340 N.E.2d 515 (1976); Marmer v. Board of Registration of Chiropractors, 358 Mass. 13, 260 N.E.2d 672 (1970). Such an

interest cannot be taken from readily identifiable persons without "an opportunity...granted at a meaningful time and in a meaningful manner," Armstrong v. Manzo, 380 U.S. 545, 552 (1965), "for [a] hearing appropriate to the nature of the case." Mullane v. Central Hanover Bank & Trust Co., 339 U.S. 306, 313 (1950).

3. As construed by the Court, Mass. G. L. c. 30A, §1, violates the due process clause of the Fourteenth Amendment inasmuch as it allows an administrative agency to determine the legal rights of obviously affected persons, without the procedural safeguards of an adjudicatory hearing, simply by failing to name them as parties to the proceeding. The agency may thus shut down an entire industry, by banning its only product, under the guise of "legislating" as to the product itself.

The fundamental liberty and property interests at stake in the Commissioner's proceedings, Cafeteria and Restaurant Workers Union v. McElroy, 367 U.S. 886, 895 (1961); Greene v. McElroy, 360 U.S. 474, 492 (1959); Schware v. Board of Bar Examiners, 353 U.S. 232, 238 (1957), mandated that plaintiffs be granted something more than a "legislative" hearing before their industry could be banned in the Commonwealth. Plaintiffs were permanently deprived of their livelihoods without so much as a right of cross-examination. A state agency cannot constitutionally deny the due process rights to an oral, evidentiary hearing, with testimony under oath and the right to confront and cross-examine witnesses, Memphis Light, Gas and Water Div. v. Craft, 436 U.S. 1 (1978); Vitale v. Planning Board of Newburyport, 1980 Mass. Adv. Sh. 1693, 409 N.E.2d 237 (1980), simply by electing not to name affected persons in its proceedings. To the extent that Mass. G. L. c. 30A, §1, permitted the Commissioner to do so, it should be reconsidered and struck down by this Court.

4. The Court's opinion erroneously states that plaintiffs "do not contend that these regulations result in a taking of property in violation of their substantive due process rights." Slip op. at 28. In fact, C. P. Chemical Company specifically contended in its brief that the repurchase regulations "violate the substantive due process guarantees of the Massachusetts and Federal Constitutions." Brief at 173. In addition, C. P.'s complaint explicitly raised a substantive due process challenge to the ban regulation. Although the Court ruled on one aspect of C. P.'s substantive due process argument--that the retroactivity of the regulations is unlawful--it did not address C. P.'s contention that the regulations do not "bear a real and substantial relation to the public health or welfare." Brief at 177.

Laws interfering with the right to engage in an otherwise lawful occupation must be substantially related to the public welfare. Coffee-Rich, Inc. v. Commissioner of Public Health, 348 Mass. 414, 204 N.E.2d 281 (1965). Although the ban regulations effectively confiscate plaintiffs' businesses, and destroy the entire Massachusetts UFFI industry, their relation to the public welfare is simply not demonstrated by the record. In particular, the record contains no evidence that formaldehyde is harmful regardless of dosage, that UFFI contributes a toxic or irritant level of formaldehyde to an insulated home, or that Tripolymer 102 causes any adverse health effects whatsoever.

The absence of such evidence robs the Commissioner's ban regulations of their rational basis and renders them arbitrary and capricious in violation of plaintiffs' substantive due process rights. Since, for example, the Commissioner did not affirmatively find a level at which formaldehyde exposure becomes harmful, his adoption of a zero-risk standard was purely arbitrary; indeed, his own witness testified that formaldehyde is not hazardous to the general population at levels below 0.1 ppm. Since he did not know whether UFFI homes contained more formaldehyde than non-UFFI homes, moreover, he could not rationally determine that UFFI contributes a level threatening "substantial personal injury or substantial illness." Most important, since the Commissioner admittedly knew nothing at all about the nature or properties of Tripolymer 102, his extension of the ban to such a product can only be regarded as capricious. Indeed, unrebutted evidence in the record establishes that Tripolymer 102 poses none of the risks the Commissioner sought to avoid in banning UFFI. The Commissioner could not reasonably conclude, therefore, that regulation of Tripolymer was either necessary or even beneficial to the public welfare.

5. The Court erred in holding that the findings the Commissioner must make before banning a substance pursuant to G. L. c. 94B, §1 need not be affirmatively supported by facts in the record. Slip op. at 19. Those findings--(1) that the regulated substance may cause "substantial personal injury or substantial illness" in its customary or reasonably forseeable usage, and (2) that the public health and safety can be adequately protected only by a total ban of the product--are prerequisites both to the Commissioner's statutory authority to ban a hazardous substance and to his right to exercise the police power of the Commonwealth without running afoul of the substantive due process limitations of the Massachusetts and United States Constitutions. See Coffee-Rich, Inc. v. Commissioner of Public Health, supra. Without a demonstrable basis in the record, the Commissioner's actions must be deemed arbitrary, capricious, and unconstitutional.

Despite the Court's characterization of the hearings as "legislative," then, the Commissioner was constitutionally required to reach affirmative findings rationally supported by evidence in the record, at least as to the issue of the necessity of a ban. Instead, he made his findings on the basis of speculation, ignorance, and an unlawful reversal of the burden of proof. Since the record is devoid of evidence supporting the statutorily mandated findings, the Commissioner exceeded his authority and violated the substantive due process provisions of the Fourteenth Amendment.

6. As construed by the Court, Mass. G. L. c. 94B is unconstitutional in that it permits the Commissioner to ban a substance, and thus to devastate an entire industry, if he has "any conceivable ground," slip op. at 19, for concluding that removal of the substance from commerce is warranted. This standard of review fails to confine the authority of an administrative agency to cases in which regulation is substantially and demonstrably necessary to the public welfare, as required by the substantive due process clause of the Fourteenth Amendment. Because, as discussed above, the Commissioner's ban of UFFI lacked a rational basis in the record, it must be struck down.

7. The Court erred in upholding the Commissioner's ban even though the evidence relied upon by the Court as justifying such action was first produced at the time of appellate review. The Court also errs in immunizing the administrative record from appellate challenge, slip op. at 18-19, and in placing the burden on plaintiffs to prove that the agency's action lacked any conceivable basis at the time of trial. Slip op. at 19, 23. The net effect of these rulings is to render the agency proceeding meaningless and to violate plaintiffs' procedural due process rights.

Since, according to the Court, evidence supporting the Commissioner's action need not appear in the administrative record, the Commissioner has no burden whatsoever at that stage of the proceedings. He need not base his decision on the agency record; indeed, the agency record serves no real function at all. Rather, the Commissioner is required only to gather and produce evidence in time for trial, and the "rational basis" for the ban may be no more than an ex post facto rationalization of arbitrary and capricious agency action. Plaintiffs have no opportunity to respond to this evidence, however, until long after the agency has taken action. Even if no adjudicatory hearing is required prior to a ban, therefore, plaintiffs have nevertheless been denied an opportunity to be heard "at a meaningful time and in a meaningful manner." Armstrong v. Manzo, supra.

The violation of plaintiffs' due process rights is exacerbated by the Court's failure to grant due deference to the findings of Justice Ronan. Although a trial court's findings are to be overturned only if "clearly erroneous," e.g., Cast Iron Soil Pipe Institute v. Board of State Examiners of Plumbers and Gas Fitters, 8 Mass. App. Ct. 575, 396 N.E.2d 457, 465 (1979), the Court rejected them in this case without any mention of the applicable standard of review. What little protection the trial afforded plaintiffs against the Commissioner's belated rationalization of the ban was substantially undermined by the Court's inexplicable dismissal of the trial court's decision. The trial thus constituted no more of a "meaningful" opportunity to be heard than did the agency proceedings.

8. The Commissioner's ban of UFFI is both overbroad and void for vagueness. Because he had no evidence that Tripolymer 102 poses a significant risk of substantial illness or injury to Massachusetts consumers, the Commissioner could not lawfully include Tripolymer 102 in the ban. The Court's decision allows him unilaterally to extend the scope of his authority simply by calling the object of his regulations "generic." Nothing in the record, however, even remotely suggests that "all foam insulation substances containing formaldehyde," slip op. at 33, share similar chemical properties or create similar hazards.

By the same token, the Commissioner's failure to define "UFFI" prevents manufacturers and dealers of substances arguably falling within this "generic" classification from determining, with any certainty, whether their businesses may lawfully be carried on in Massachusetts. Although the evidence hardly justified the Commissioner in regulating "all foam insulation substances containing formaldehyde," manufacturers and dealers face criminal penalties if they guess incorrectly at the meaning of "UFFI" in the ban regulations. Both

this Court and the United States Supreme Court have held regulations void if they fail to provide adequate warning of the conduct proscribed. Hynes v. Mayor of Oradell, 425 U.S. 610 (1976); Druzik v. Board of Health of Haverhill, 324 Mass. 129, 85 N.E.2d 232 (Mass. 1949). Regardless of whether the Commissioner must "incorporate the chemical definition of [UFFI]," slip op. at 40, the ban regulations are unconstitutionally vague because they fail to provide any criteria by which affected persons can measure the legality of their conduct.

9. The Commissioner's ban regulations violate plaintiffs' procedural due process rights in that they make no provision for the exemption of products that do not emit a harmful level of formaldehyde. Plaintiffs have no opportunity to establish that, as in the case of Tripolymer 102, their products differ chemically or operationally from UFFI. By regulating UFFI generically, moreover, the ban regulations unlawfully raise an irrebuttable presumption that "all foam insulation substances containing formaldehyde" pose the health risks the regulations are designed to eliminate. See Stanley v. Illinois, 405 U.S. 645 (1972).

10. The Court erred in holding that the Commissioner had properly included Tripolymer 102 in the ban without an adjudicatory hearing. Counsel for the Commissioner conceded in oral argument before the Court that C. P. Chemical was entitled to a trial-type hearing as to whether the inclusion of Tripolymer was arbitrary and capricious. See letter of Michael S. Marcus, Esq. to the Chief Justice, November 18, 1982. Because this issue was properly considered for the first time by the trial court, no deference to the agency is due and Justice Ronan's findings must be affirmed unless clearly erroneous. See Cast Iron Soil Pipe Institute v. Board of State Examiners of Plumbers and Gas Fitters, supra; Building Inspector of Lancaster v. Sanderson, 372 Mass. 157, 161, 360 N.E.2d 1051, 1054 (1977). Since C. P. Chemical Company's evidence as to Tripolymer was uncontradicted at trial, the Court should reinstate Justice Ronan's decision that Tripolymer 102 was not rationally included in the ban of UFFI.

11. The Court erred in interpreting Mass. G. L. c. 94B, §2, as requiring the Commissioner's ban regulations to conform only substantively, and not procedurally, to regulations promulgated pursuant to the Federal Hazardous Substances Act. Given the fundamental liberty and property interests threatened by the Commissioner's regulations, the similarity of language between c. 94B and the FHSA, and the lack of any distinction in c. 94B between "procedural" and "substantive" conformity, the Massachusetts statute must be read to incorporate the right to an adjudicative hearing protected by the FHSA.

12. As construed by the Court, Mass. G. L. c. 94B, §2 is unconstitutional. The FHSA embodies the minimum procedural due process safeguards described above, insuring that a substance not be banned by the federal government without affording adversely affected persons the right to an adjudicative hearing. Pactra Industries, Inc. v. Consumer Product Safety Commission, 555 F.2d 677 (9th Cir. 1977); Spring Mills, Inc. v. Consumer Product Safety Commission, 434 F. Supp. 416 (D.S.C. 1977). Regulations that do not "conform"

procedurally with the FHSA also do not comply with the dictates of the Fourteenth Amendment. To the extent that the statute does not require an adjudicatory hearing prior to the ban of a hazardous substance, it violates the procedural due process rights of affected persons.

13. The Court erroneously construed Mass. G. L. c. 94B, §8, as limiting the adjudicatory hearing required prior to repurchase to a consideration of the identity of the UFFI supplier. Although the Court correctly recognized that, pursuant to c. 94B, §8, a banned hazardous substance "shall" be repurchased, it failed to note that the statute requires repurchase only "in accordance with regulations of the commissioner...." The Commissioner's regulations raise a variety of medical and legal issues that must be resolved in the consumer's favor before he is entitled to repurchase. Like any other regulations promulgated by an administrative agency, moreover, the Commissioner's regulations under c. 94B must respect the due process rights of affected persons. The statutory "shall," therefore, does not grant the Commissioner unlimited authority to demand repurchase, and the Court erred in holding that repurchase becomes mandatory upon identification of the supplier.

14. Even if correctly construed by the Court, G. L. c. 94B, §8 violates the Massachusetts Declaration of Rights and the Fourteenth Amendment in that it permits the taking of liberty and property without granting plaintiffs an opportunity to litigate all relevant issues or to raise all available defenses. Because the repurchase regulations authorized by c. 94B apply retroactively to persons who have already sold and installed UFFI in Massachusetts, they are neither of general applicability nor of purely prospective effect. On the contrary, they determine the rights of, and impose a remedy against, a readily identifiable group of sellers and installers. The effect of the regulations, therefore, is precisely that of an adjudication. Because c. 94B permits an agency to promulgate such regulations without the safeguards of an adjudicatory hearing, it violates the procedural due process rights of affected manufacturers and dealers.

15. Even if constitutionally promulgated pursuant to c. 94B, the Commissioner's repurchase regulations violate plaintiffs' procedural due process rights. While the Court correctly held that an adjudicatory hearing must be granted on the issue of the supplier's identity, due process demands much more. As courts construing the FHSA have held, the drastic nature of the repurchase remedy and the extraordinary expense involved necessitate that manufacturers and dealers be afforded a full-scale adjudicatory hearing before the deprivation of the vested property interest that an already-completed sale entails. Pactra Industries, supra; Spring Mills, supra. See also Keniston v. Board of Assessors of Boston, 380 Mass. 888407 N.E.2d 1275 (1980). This is particularly so because repurchase is a retroactive remedy; it requires the undoing of a sale that was perfectly legal at the time it was made. As the Supreme Court and the Third Circuit have noted, retroactive legislation must meet a stricter due process test than purely prospective measures. Usery v. Turner Elkhorn Mining Co., 428 U.S. 1 (1976); Daughters of Miriam Center for the Aged v. Matthews, 590 F.2d 1250, 1259 (3d Cir. 1978).

The Commissioner's regulations are constitutionally deficient insofar as they deny a supplier the opportunity to offer evidence and to confront witnesses on all of the factual issues that are raised by a consumer's request for repurchase. By requiring written submissions from the consumer regarding his medical history, the Commissioner implicity puts in controversy such issues as the genuineness of the reported symptoms and their relation to UFFI exposure. Yet the supplier may not cross-examine the consumer, obtain an independent physical examination, or offer oral evidence. At the same time, the regulations require repurchase unless the supplier clearly and convincingly disproves the consumer's factual allegations. Thus, the Commissioner not only places a heavy burden of persuasion on the supplier, but also denies him any effective means of carrying his burden.

Whether the Court is correct in deeming the Commissioner's submission of these issues to the referees "gratuitous" under the statute is immaterial; to the extent that the statute precludes litigation of the issues, it violates due process. Once having raised the issues, moreover, the Commissioner cannot lawfully resolve them in a proceeding offering less than the full gamut of procedural safeguards. With litigation of the key issues foreclosed and no right of cross-examination, the repurchase procedure will not satisfy the constitutional mandate of a "meaningful" opportunity to be heard. Armstrong v. Manzo, supra.

16. The Court utilized an incorrect standard in upholding the repurchase regulations on the ground that their retroactive applicability is "reasonable." Slip op. at 39. As stated above, retroactive agency action is subject to more exacting constitutional scrutiny; it must be "both reasonable and necessary to serve the...important purposes claimed by the state." United States Trust Co. of New York v. New Jersey, 431 U.S. 1 (1977) (emphasis added).

Even disregarding their retroactivity, the regulations cannot meet the appropriate standards of substantive due process since they require repurchase even in cases in which such a remedy will have no demonstrable effect upon public health and safety. Repurchase may be ordered despite the lack of any evidence that (1) the consumer's symptoms were substantial, (2) the symptoms occurred more than once, (3) the UFFI in the consumer's dwelling emitted formaldehyde, (4) the consumer's symptoms were caused by exposure to UFFI rather than to some other source of formaldehyde, and (5) the consumer's symptoms were related to formaldehyde exposure at all. Unless each of these facts is established in a given case, the utility of repurchase is purely speculative, the remedy is neither "reasonable" nor "necessary," and the Commissioner's order violates the substantive due process rights of the supplier.

17. The Court failed to consider the language of G. L. c. 94B, §1, in upholding the Commissioner's determination that a total ban and repurchase of UFFI was warranted. It erroneously required the Commissioner only to show, in accordance with §2(d), that UFFI "present[ed] an imminent danger to the public health and safety."

Even assuming that the Commissioner rationally made such a finding, more was required before he could ban UFFI. Pursuant to §1, he was also bound to

find that "the protection of the public health and safety can be adequately served only by keeping the substance out of the channels of commerce." This language clearly requires the Commissioner to investigate, consider, and rule out all possible alternatives before determining that only a ban will suffice to insure the public health and safety.

The Commissioner failed, however, even to consider less drastic alternatives. He cavalierly dismissed evidence, persuasive to Justice Ronan, that proper installation standards could adequately control the risks of formaldehyde exposure. Rather than seek out additional regulatory methods on his own, he reversed his statutory burden, finding that plaintiffs had failed to prove the availability of other alternatives. Once again, he failed to meet the prerequisites to his authority to order the ban and repurchase of UFFI.

18. The Court should grant a rehearing in order to consider whether regulation of UFFI by the Commissioner was preempted by federal regulation of the field. Although plaintiffs did not brief the issue in this Court because it was unnecessary to Justice Ronan's decision, the preemption question goes to the heart of the constitutional relationship between federal and state governments and therefore merits renewed consideration by the Court.

Several agencies of the United States Government have undertaken regulation of UFFI and formaldehyde products. Far from banning them outright, these agencies have recognized UFFI as an important ingredient of the national energy policy. Proposed Department of Energy regulations, for example, state that any formaldehyde emission problem associated with UFFI can be prevented by adequate material and installation standards. 46 Fed. Reg. 16546, 16571 (March 19, 1979). The Treasury Department, similarly, recognizes UFFI as a qualified item for which consumers may take energy tax credits against their federal income taxes. UFFI has been approved by the Department of Housing and Urban Development for use in buildings eligible for federal funds, see "HUD Use of Materials Bulletin Number 74," and formaldehyde emission standards for the workplace have been established by the Occupational Health and Safety Administration. 29 C.F.R. § 1910.1000(Z).

Given this pervasive scheme of federal regulation, state control of UFFI must be deemed preempted. The Commissioner's regulations are inconsistent, moreover, with the federal integration of UFFI into the national energy policy. Under these circumstances, the regulations are invalid under the Supremacy Clause of the United States Constitution. City of Burbank v. Lockheed Air Terminal, Inc., 411 U.S. 624 (1973).

19. The Commissioner's regulations unduly burden interstate commerce without any countervailing local benefit, and are therefore unconstitutional. In striking down the CPSC ban in Gulf South, the Fifth Circuit not only confirmed the legality of interstate distribution of UFFI, but also rejected the contention that a ban is necessary to protect the public health and safety. Accordingly, C. P. Chemical Company's business is lawful everywhere but in Massachusetts, where, on the basis of evidence found insubstantial by the Fifth Circuit, it is not

only prohibited from making further sales but must also incur the extraordinary expense of repurchasing its product from consumers.

In determining whether a particular regulation impermissibly burdens interstate commerce, this Court must look behind the Commonwealth's justification therefor and independently weigh the competing state and federal interests. Raymond Motor Transportation, Inc. v. Rice, 434 U.S. 429 (1978). The Supreme Court in Raymond Motor Transportation invalidated a Wisconsin regulation restricting the operation of trucks over fifty-five feet long and of double-trailer trucks traveling on interstate highways. The state had failed, the Court held, to demonstrate that the regulations contributed to highway safety. Here, too, the Commissioner has obstructed the flow of interstate commerce without any rational basis for concluding that a ban is necessary to protect the Commonwealth's consumers. The local benefit of his regulations is illusory and cannot outweigh the obvious burden on interstate commerce.

20. The ban of UFFI deprives UFFI manufacturers and distributors of their constitutional right to the equal protection of the laws. Although unable to quantify the formaldehyde levels in UFFI homes, the Commissioner nevertheless singled out UFFI for classification as a "banned hazardous substance" pursuant to G. L. c.94B. Lacking this information, the Commissioner had no rational basis for treating UFFI differently from other formaldehyde-emitting products such as gas ranges, plywood, and cigarettes. Such an arbitrary distinction among similarly-situated businesses plainly violates the equal protection clause of the Fourteenth Amendment. Thompson v. Gallagar, 489 F.2d 443 (5th Cir. 1974). See generally McGinnis v. Royster, 410 U.S. 263, 276-77 (1973).

For all of the foregoing reasons, C. P. Chemical Company, Inc. respectfully requests that its petition for rehearing be granted.

Respectfully submitted,

Michael S. Marcus/CJZ

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Counsel for C. P. Chemical Company, Inc.

csf

cc: All Counsel of Record

SUPREME JUDICIAL COURT FOR THE COMMONWEALTH
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June 1, 1983

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Gentlemen:

Re Borden, Inc. vs. Comm'r of Public Health
(and four consolidated cases)
Supreme Judicial Court No. SJC-2849

Your Petition for Rehearing in the above-captioned case has been considered by the Court and is denied.

Very truly yours,

Clerk

PJH/pc

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JONATHAN E. FIELDING, M.D., M.P.H.
COMMISSIONER

August 10, 1978

FOR YOUR INFORMATION

TO: LOCAL BOARDS OF HEALTH

FROM: DAVID KINLOCH, M.D
DEPUTY COMMISSIONER

SUBJECT: UREA FORMALDEHYDE FOAM INSULATION

Several weeks ago the Department of Public Health was requested by the Executive Office of Consumer Affairs to obtain and test air samples from the homes of individuals who had registered complaints, or concern, regarding the presence of formaldehyde vapor following installation of urea formaldehyde foam (UFF) insulation. The majority of calls from consumers had been prompted by a television program describing the problems encountered by one Massachusetts family. UFF is a form of insulation in extensive use for insulating the walls of existing homes. It is pumped into wall cavities as a soft foam which quickly solidifies. This material is not recommended for installation in attics. UFF insulation has been used for many years in Europe but has come into widespread use in this country only in the past several years. It is estimated by industry representatives that about 45,000 homes in Massachusetts have been insulated with UFF.

A total of 73 homes were visited and air samples taken. These were subsequently analyzed for the presence of formaldehyde by the laboratory of the Division of Occupational Hygiene of the Department of Labor and Industries. The results are set out in Table 1.

Formaldehyde vapor is present in low concentration in the air of most cities, generally several hundredths of 1 part per million (ppm). It is unnoticeable, and without apparent harmful effects. Exposure to higher levels, generally above where a disagreeable odor is first noticed, can produce irritation of the eyes, nose, and throat; skin eruptions; and sometimes more general complaints, such as disturbed sleep and nausea, in some, but not necessarily all, persons. There are no conclusive data to indicate that there are long term effects from exposure to formaldehyde.

In work sites, where formaldehyde is used or produced, the current acceptable concentration, in Massachusetts, is 2 ppm. The acceptable level may soon be reduced to 1 ppm on the basis of recommendations by the National Institute for Occupational Safety and Health. This recommended level presumes an exposure for up to 10 hours per day or 40 hours per week.

For the test method used, the Department considers that results of less than 0.1 ppm would not be associated with any symptoms; that levels between 0.1 and 0.5 ppm could, but in most cases would not, result in symptoms; but that above 0.5 ppm an increasing proportion of exposed individuals may be bothered by formaldehyde odor, and may experience irritation of the eyes, nose, and throat; some individuals may develop nausea, or have difficulty sleeping.

The Department has written to those individuals whose homes were tested, provided test results and its interpretation of those results. Where formaldehyde levels above 0.5 ppm have been measured the Department recommends increased ventilation until the excessive formaldehyde release can be corrected. Industry representatives met with representatives of concerned Massachusetts state agencies and gave assurances that problems would be corrected to the satisfaction of the affected homeowners.

The problems appear to have arisen from faulty or improper installation. The Executive Office of Consumer Affairs proposes to avert future problems through licensure of insulation applicators, and controls over insulation materials.

Any individuals seeking information or wishing to report problems may be referred to the Executive Office of Consumer Affairs at 727-7780, which is acting as the coordinating agency in dealing with these matters. The Department of Public Health will soon embark upon a testing program to confirm our impression that formaldehyde vapor problems are encountered in only a small proportion of installations, and that these problems are associated with improper technique. This program will be supported in part by a grant from the Federal Department of Energy.

TABLE 1

ALDEHYDE (ppm)	NUMBER OF HOMES
less than 0.1	19
0.1-0.4	18
0.5-0.9	20
1.0-1.4	6
1.5-1.9	4
2.0-2.4	3
2.5-2.9	3
TOTAL	73

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November 28, 1978

David Kinloch, M.D.
Deputy Commissioner
Department of Public Health
600 Washington Street
Boston, Massachusetts 02111

and

Laurence Buxbaum, Esq.
Assistant Secretary
Executive Office of Consumer Affairs
One Ashburton Place
Boston, Massachusetts 02111

Re: Notice of November 16 Concerning Distribution and Installation of Urea-Formaldehyde Foam

Gentlemen:

This is in response to your letter of November 16, 1978 to C. P. Chemical Company, Inc., of 25 Home Street, White Plains, New York on the above subject.

Your communication alleges that there are many serious health, safety and odor problems caused by urea-formaldehyde foam insulation and that the industry has failed to identify the causes of the problems or remedy them. It is neither the purpose of this response nor would it even be possible at this time to present a detailed refutation or discussion of such charges. Of the "hundreds of complaints" referred to, C. P. Chemical Company is only in receipt of certain limited information with respect to 34 "complaints".

The instant response will, however, demonstrate with respect to C. P. Chemical Company that: (1) to the extent any "complaints" allegedly involving C. P. (one to date) have been provided to C. P.

it has identified and solved the problem; (2) C. P. is providing herewith certain of the information requested by the Commonwealth and will provide the vast majority of the remaining information reasonably requested and available to C. P. within the next week; and (3) C. P.'s failure to respond to the Commonwealth's letter of October 2, 1978 was occasioned by a mistaken conception of the responsibilities being undertaken by the National Association of Urea Foam Insulation Manufacturers.

Initially, however, as to the 34 complaints against industry members made available by Massachusetts, we must note that a detailed status report was forwarded to Ms. Barbara Neuman of the Massachusetts' Office of Consumer Affairs by Mr. Charles Campbell on behalf of the National Association of Urea Foam Insulation Manufacturers on November 17, 1978, the day after your aforementioned letter to C. P. Chemical Company. Briefly, the November 17 status report indicates that the Association determined whether or not a bona fide formaldehyde problem existed and, where warranted, the Association took or is in the immediate process of taking adequate remedial action.

Of course an ultimate determination of whether or not each of the 34 identified complaints has been satisfactorily resolved awaits a follow up test to determine present formaldehyde levels. It is my understanding that the Association expects this will be done by Massachusetts (with the assistance of the Association if the Commonwealth desires) as the consumer would doubt the Association's results and the Commonwealth will want to check on the final results obtained and the veracity of both the Association's representatives and the complainants. Thus, even with respect to the 34 industry complaints made available, it would seem certainly premature to comment further on the charges contained in your November 16th letter which issued before receipt of the Association's status report and prior to any retesting of formaldehyde levels and an evaluation of the obtained results. In view of the Association's investigations and remedial actions, any further comments may well be totally unnecessary.

Over and above the foregoing, C. P. Chemical Company's lack of relationship or at best minimal relationship to the problems you detail must be recognized lest such problems be unfairly and improperly attributed to C. P. Of the 34 complaints identified by

Massachusetts only one, that of John Getter, was attributable to an installer who used a urea based resin manufactured by C. P. Chemical Company. C. P. Chemical Company had voluntarily commenced investigating Dr. Getter's problem in June 1978 long prior to the July 26, 1978, meeting between officials of Massachusetts and the industry. C. P. has also kept your offices directly advised as to the status and resolution of the Getter complaint on a continuing basis. In this regard, please see Ms. Reinbergen's letter of September 6, 1978, to L. Buxbaum (cc Dr. Kinloch) and Ms. Caponneto's letter of October 13, 1978, (cc Dr. Kinloch). To summarize, Dr. Getter's residence was inspected because of complaints of slight eye sensations. The State's own tests showed only .3 ppm formaldehyde, a low and generally acceptable level. Ultimately it was determined that the problem was created by the air conditioning system, a closed internal system. Thereafter it was decided that dampers would solve the problem and they were ordered with the consent of Dr. Getter, all at C. P.'s expense. After a 6 week delay by the manufacturer in filling the order, the dampers are on hand for installation.

To place this matter in proper perspective, it should be noted that available information at C. P. indicates that installers have placed foam insulation made from C. P. Chemical Company's resin in approximately 500 residential homes in Massachusetts from October 1976 through October 1978. Thus the Getter problem represents an incident rate of only 00.2% assuming arguendo that one should even list this as a formaldehyde problem rather than an air conditioning or air circulation problem. It is important to note in this "incident" (a) the formaldehyde level was clearly not a health or safety hazard; (b) C. P. investigated, identified the problem and sought to resolve it in a rapid, responsible manner; and (c) C. P. kept Massachusetts advised of the information it obtained and the work done in resolving the problem. Unless and until Massachusetts provides C. P. with the information relating to other complaints, if any, involving its products, Massachusetts cannot properly or legally take the position that there are any incidents of formaldehyde problems due to C. P.'s products in Massachusetts for upon analysis and/or investigation of any such other complaints by C. P. or independant laboratories it may be proven that the complaint is not bona fide or the problem involves things other than formaldehyde or C. P.'s product.

C. P.'s product is different from that of its competitors because it contains an additional component. Thus, information which Massachusetts may have about other urea-based foams is not necessarily or even probably applicable to C. P.'s product. As the foregoing information establishes, C. P.'s product is a safe product to use

as insulation in the homes of Massachusetts. Despite this, your letter, at page 2, alleges the necessity of further information from C. P. to enable Massachusetts to make this determination.

When reviewing the categories of such information requested of C. P. in the instant letter we were extremely surprised because it was C. P.'s understanding that such requests were to be directed to and negotiated with the National Association of Urea Foam Manufacturers.* In fact, requests (a) and (c) (Requests 1 and 3 in the letter of October 2, 1978) had been directed to the president of the Association at the July 26, 1978 meeting by the Commonwealth Officials; the president had explained the impossibility or impracticability (within the time period demanded) of providing such information; and his position had appeared to have been accepted by the State Officials.

Since it is now apparent that Massachusetts seeks the categories of information set forth at pages 2 and 3 of your November 16, 1978 letter from each manufacturer on a direct, immediate basis, I will set forth C. P.'s position with respect to each category, provide the information immediately available and advise as to the time necessary to provide a complete response where appropriate.

Category "a"

Complete Listing of all Foam Installations in Massachusetts Homes - C. P. will provide the information with respect to the homes insulated with foam made from its resin to the extent it can obtain such information from the independant installers who use C. P.'s products. In view of the number of installations involved (500 or more) C. P. estimates it will need 60 days to obtain, compile and provide such information to the Commonwealth.

* When such information requests were forwarded originally to C. P. on October 2, 1978, it was assumed this had been an inadvertent mistake or provided simply for C. P.'s information and that the resolution of what information would be voluntarily collected and provided to Massachusetts would be worked out by or through the Association.

Category "b"

Results and Methodology of Testing of Air or Foam from Massachusetts Homes - C. P. will respond to this category with respect to tests performed by it or on its behalf. C. P. understands that this category is directed to residential homes. Thus, the information requested relates to the "Getter" complaint and insofar as it has not already been provided such information will be provided within the next week.

Category "c"

Statement as to Safe Level of Formaldehyde - Absent an understanding of the meaning or definition of "safe" in this context and absent exhaustive laboratory tests, C. P. cannot state an opinion as to a maximum level or concentration of formaldehyde which would be "safe" for homes in Massachusetts. In view of C. P.'s record to date and absent extensive proof of a large number of instances in which C. P.'s products (as opposed to those of its competitors) have been directly proven to have seriously impared the health of individuals it would be unjust and improper to require C. P. to arbitrarily designate some extremely low formaldehyde level as being the so-called "safe" level.

Category "d"

Analysis of Accuracy of Massachusetts' Testing - C. P. does not have direct knowledge of all the tests and testing procedures used to date by Massachusetts. C. P. has certain hearsay information of a general nature that Massachusetts in the past has used a Drager tube test and is presently about to shift to a NIOSH approved method. C. P. believes, and has evidence to substantiate its belief, that the Drager method is extremely inaccurate and gives worthless, misleading analytical results on both a qualitative and quantitative basis. If Massachusetts will provide C. P. with the details of its past and present tests and test methods, C. P. will provide the Commonwealth with its opinion of them.

Category "e"

Description of Remedies Available where Formaldehyde Odor Problem Exists - C. P. Chemical Company has limited experience with the use of ammonia, bad air sponges, air vents, and the removal of foam insulation to correct or obviate unduly high formaldehyde concentrations. The details of such procedures will be provided

to the Commonwealth within one week. C. P. has no direct experience with the other methods enumerated at page 3 of your letter. However, should the Commonwealth still desire C. P.'s evaluation of these other remedies, C. P. will comply.

Category "f"

Installers and Distributors who use C. P.'s Products in Massachusetts - C. P. will provide the listings requested by the Commonwealth within one week.

Categories "g" and "h"

Chemical Composition and Safety of Each "Remedy" - At present the only chemical remedy employed to any degree by C. P. Chemical is the use of ammonia, i.e., an aqueous solution of NH_3. Since this is commonly used in the home for numerous purposes, it is C. P.'s position that the foregoing should be a sufficient response to categories (g) and (h).

Conclusions And Position Of C. P. Chemical Co.

We believe the foregoing demonstrates:

(a) There was only one investigated complaint concerning a residence involving C. P. Chemical; assuming arguendo the problem could be characterized as relating to formaldehyde, this would only be a 00.2% incident rate;

(b) Based on the State's own test, the "complaint" involved a very low and therefore "safe" level of formaldehyde by anyones standards, complete investigation showed the problem to be in the air conditioning or air circulation system;

(c) It was dealt with* on a rapid, reasonable basis by C. P.;

(d) The problem, inadequate air circulation, was identified by C. P.; a solution acceptable to the consumer was found; and the Commonwealth was kept informed of C. P.'s actions in this regard in a direct, ongoing manner;

* C. P.'s investigation commenced well prior to any Commonwealth demands or intervention.

(e) C. P. uses no "dangerous" chemicals to remedy formaldehyde problems; and

(f) C. P. Chemical will provide the information requested by Massachusetts within certain reasonable limits in a prompt timely manner as that information is received and compiled.

In conclusion, it has been demonstrated that there is no basis for any presumption that C. P.'s products are dangerous to health or safety or that C. P. is or intends to withhold information which would assist the Commonwealth in determining the safety of C. P.'s products in the homes of Massachusetts. Rather, the information now available to Massachusetts proves or raises the presumption that C. P.'s product presents no health or safety problems when installed in the home. Thus, there is no justification for banning the sale and/or use of C. P.'s products in Massachusetts.

It is C. P.'s position, based on the information available to it, that it would be procedurally and substantively improper and unlawful for Massachusetts to ban the sale and/or use of its products in the Commonwealth.

Respectfully submitted,

Gerald J. Flintoft
Attorney for C. P. Chemical Company, Inc.

Statement Re Service

The undersigned acknowledges and thanks Mr. Buxbaum for granting C. P. permission to provide the Commonwealth with this written response on November 29, 1978 rather than on November 27, 1978 as originally requested in Dr. Kinloch's and Mr. Buxbaum's letter of November 16, 1978. The instant response will be hand delivered to the offices of Dr. Kinloch and Mr. Buxbaum on November 29, 1978 by Archer Air Courier Systems.

Gerald J. Flintoft

cc: Clare Reinbergen

Alfred L. Frechette, M.D., M.P.H.
Commissioner

The Commonwealth of Massachusetts
Department of Public Health
600 Washington Street
Boston 02111

January 12, 1981

Ms. Clare H. Reinbergen
C.P. Chemical Co., Inc.
39 Westmoreland Avenue
White Plains, NY 10606

Dear Ms. Reinbergen:

Your letter of December 12, 1980, to Commissioner Frechette, has been referred to me for reply. In your letter, you assert that the product TRIPOLYMER, marketed by C.P. Chemical Co., is not a urea-formaldehyde foam insulation (hereinafter UFFI). It is this Department's position that TRIPOLYMER must be considered a UFFI product, and as such is subject to the ban against all UFFI products which became effective November 14, 1979. The reasons for this determination are as follows.

In your affidavit testimony before the Massachusetts Department of Public Health during public hearing held on March 29 and 30, 1979, you state at page 4:

> Although TRIPOLYMER falls within the generic category of a urea-formaldehyde containing foam insulation, it also contains an additional fundamental chemical ingredient...(emphasis added).

In Aerolite SPE Corporation; C.P. Chemical Co., Inc., et. al. v. Massachusetts Department of Public Health, Suffolk Superior Court Civ. Ac. No. 38473, the amended complaint states at pp. 2-3:

> 4. The plaintiff C.P. Chemical Company, Inc...manufactures products used in the manufacture of a urea-formaldehyde based foamed-in-place insulation... At least 500 Massachusetts homes have been insulated with a urea-formaldehyde based foamed-in-place insulation manufacturered from materials supplied by plaintiff, C.P. Chemical Company, Inc.

The Department considers the above statements to be admissions that TRIPOLYMER is in fact a UFFI product.

In addition, I have enclosed a copy of a letter dated May 31, 1978 from William H. Snyder, Professor of Chemistry at the New Jersey Institute of Technology to Tania Jillions of the New Jersey Department of Energy. In the letter, Professor Snyder details the results of scientific tests he performed on TRIPOLYMER, and concludes that "Tripolymer Foam contains almost 30% by weight of combined formaldehyde which can be released to the surroundings by reaction of the polymer with atmospheric moisture over long periods of time."

This Department concludes that TRIPOLYMER is a urea formaldehyde foam insulation within the meaning of 105 CMR 650.020, the ban of UFFI, and 105 CMR 650.222, governing repurchase of UFFI.

Any person who sells UFFI, exposes it for sale, delivers it, gives it away, possesses it or delivers it for introduction into commerce is punishable by a fine of $100 to $500 and/or imprisonment up to 90 days for the first offense. Second and subsequent offenses carry a fine of $600 to $3,000 and/or imprisonment up to one year. The Department of Public Health also has the power to seek equitable relief in Superior Court.

The Director of the Division of Food and Drugs, or an authorized inspector of that division, has the power to embargo any substance s/he finds or has probable cause to believe has been banned. Substances so detained may be condemned and destroyed by court order at the manufacturer's, distributor's or owner's expense.

Sincerely,

Gerald Parker

Gerald Parker
Assistant Commissioner for
Environmental Health

GP/PF/js

Enclosure

NEW JERSEY
INSTITUTE OF TECHNOLOGY
323 High Street / Newark, N.J. 07102

Newark College of Engineering
Chemical Engineering and Chemistry
Division of Chemistry

(201) 645-5390

May 31, 1978

Ms. Tania Jillions
New Jersey Department of Energy
101 Commerce Street
Newark, New Jersey 07102

Re: Analysis of Tripolymer Foam for Formaldehyde Content

Dear Ms. Jilliens:

On May 11, Mr. Duane Gautier and yourself presented me with a sample of Tripolymer Foam manufactured by C. P. Chemical Co. of White Plains, New York and asked me to obtain an analysis for formaldehyde on this material. This letter summarizes the results.

The sample as received had a definite odor of formaldehyde. As you are probably aware, formaldehyde is a gas at room temperature and boils at -21°C. There is thus a definite limit as to the amount of uncombined gas the foam can contain at room temperature. The density of the foam is about 0.026 g/ml and if the polymer component has a density of from 1 to 1.5 g/ml, the maximum uncombined formaldehyde content can be no greater than 4.5 to 4.6% by weight. Titration of foam samples using a method based on reaction of the aldehyde with hydroxyl amine yielded a formaldehyde content of 28.6%. Formaldehyde was definitely identified from the foam through its 2,4-dinitrophenyl hydrazone derivative and there were apparently no other interfering aldehydes or ketones present. The foam dissolved in dilute hydrochloric acid after heating for about 10 minutes at 100°C to produce formaldehyde and other products.

What the above results confirm is that the Tripolymer Foam contains almost 30% by weight of combined formaldehyde which can be released to the surroundings by reaction of the polymer with atmospheric moisture over long periods of time.

I have all of the analytical results recorded in a notebook and if you desire information on the technical details, I will be glad to furnish it. Also, if you want to discuss this matter further please feel free to contact me.

Sincerely,

William H. Snyder
Professor of Chemistry

cc: Dr. Kimmel